Vol. XVI AUGUST, 1930 No. 8

# The International Journal of Orthodontia Oral Surgery and Radiography

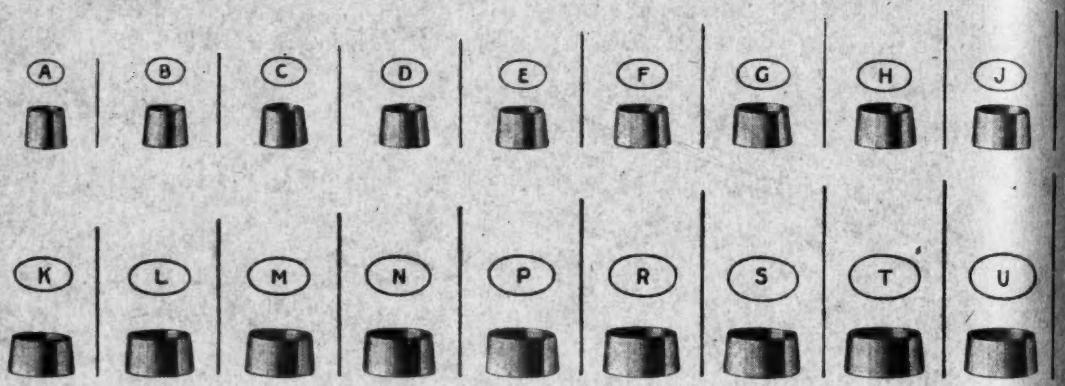




Entered at the Post Office at St. Louis, Mo., as Second Class Matter

Published by The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, U. S. A.

# WILL-GOLD SEAMLESS INCISOR BANDS




## REVOLUTIONIZED BAND FITTING TECHNIQUE IN ORTHODONTIA

WILL-GOLD Ready-Made Incisor Bands with their companion Seamless Molar Anchor Bands, are revolutionizing band fitting technique in Orthodontia.

They have entirely eliminated the need for cutting, soldering and shaping band materials. Furnished in a minute gradation of sizes, they provide, ready-made, a band of the exact size and approximate shape of any tooth. After selecting the band of proper size, adapting it to the individual case is a matter of only a few minutes.

Furthermore, the absence of soldered joints in ready-made Seamless Bands provides greater flexibility in adapting and does away with the danger of joints separating when appliances are soldered to the bands.

Will-Gold Ready-Made Incisor Bands are made in eighteen graded sizes, one of which will care for any incisor, upper or lower. Twelve graded sizes of Will-Gold Molar Anchor Bands provide for every molar. They are offered singly or in conveniently boxed assortments.

Assortment C contains two each of the eighteen Incisor Bands and sells for $12.65 in the United States

[FOR SALE BY GOOD DEALERS EVERYWHERE]

*Write for the complete story of Incisor and Molar Bands, including Dr. Pullen's technique for their use*

THE WILLIAMS GOLD REFINING CO., INC.

SAN FRANCISCO, CALIF. BUFFALO, N. Y. BRIDGEBURG, ONT.

# WILLIAMS GOLDS

## better because they are "Melted by Radio"

The International Journal of
Orthodontia, Oral Surgery and Radiography



VOL. XVI ST. LOUIS, AUGUST, 1930 No. 8

# ORIGINAL ARTICLES

## ORTHODONTIA EDUCATION*

BY T. WALLACE SORRELS, D.D.S., OKLAHOMA CITY, OKLA.

IN REVIEWING Dr. William J. Gries's report of his surveys and study of dental education for the Carnegie Foundation, we find that dentistry began first to attain importance in 1840. It was at this time that dentists in the United States established the first journal of dentistry, the first national society of dentists, and the first dental school. For nearly thirty years thereafter dentistry remained superficial. There were no educational prerequisites and no legal restrictions to its practice. It was regarded, generally, as a trade which anyone might undertake who was disposed to do so. There were ten dental schools in 1868, whose combined graduates were ninety dentists. The graduate course of training was an apprenticeship with less than a year of theoretic training. About the same year, in response to cumulative demands for greater responsibility and efficiency in dental service, the legislatures of the states began to enact laws that specified definite requirements of admission to practice and gave power of enforcement to boards of dental examiners. The public and professional importance of the regulative function of the State Board of Dental Examiners was plainly evident from the outset. The mandatory effect of these regulations made for dentistry greater strides than in all previous history. The National Association of Dental Examiners was organized in 1883, whose principal objectives were to develop a common understanding and to unify the system.

In the beginning when dentistry was loosely organized and had been rebuked by the medical schools, a large number of independent commercial schools were established. The quality of education was naturally made sub-

*Read at the tenth annual meeting of the Southwestern Society of Orthodontists, Oklahoma City, Okla., February 25, 1930.

servient to the maximum net profits. The financial returns were very handsome in institutions which were efficiently managed. It has since been clearly proved that neither graduate nor undergraduate schools can develop the highest quality of education and humanitarian service on finances consisting of fees paid by students.

The National Association of Dental Facilities was organized in 1884 and the National Council of Dental Education in 1909. The representatives of the greater educational institutions having large sectarian, state, and endowment funds for support gradually gained control of these organizations. In 1922 the point system of school grading was adopted which has forced a rapid elimination of the proprietary schools.

The general broadening of dental health service, as time elapses with its concurrent mechanical, esthetic, and medical demands, makes it impossible to practice expertly all aspects of it. As a consequence several important specialties have arisen. By reason of its outstanding reconstructive character and major evidences of preventive and curative quality, the art of correcting irregularities of the teeth and dentofacial deformities has made the practice of orthodontia one of the most important utilities in dentistry. In addition the complicated technical, clinical, and scientific character of this branch of dentistry has made it possible to develop into the leading specialty of dentistry. Oral surgery has since acquired the distinction of an accredited dental specialty, and others, such as periodontia, prosthodontia and pedodontia are among those attaining concreteness and rapidly increasing in number. The scope, complexity, and difficulties that arise in preparing for the practice of any one of the specialties are of such magnitude as to lead one to believe that it is even impossible for anyone to acquire a full knowledge of its possibilities, and, I might add, its responsibilities.

In holding this brief review of the evolution of general dental education in mind and in comparing it with the development of orthodontia education since it was first established as a specialty some thirty years ago, one will find great similarity. Sincere preparation for specialization in the different branches is being attained chiefly by self-training or private instruction in the short course proprietary schools. The dental schools, with but about four exceptions, have failed to provide proper courses of instruction for specialization. The general practitioners desiring additional knowledge and training to prepare for specialized practice and those wishing to increase their general fitness for the practice of the several major branches have been left exposed to commercial enterprises. Dental supply houses and certain other commercial agencies and individual dentists with itinerant courses have been in a large measure supplying the need. Some of them are compatible with professional ethics, and doubtless merit a place in dental education, but advanced dentistry should not be so completely dependent upon commercial education. We should learn to look to our higher educational institutions for graduate instruction as well as for the undergraduate courses. The older methods filled the gap and served a useful purpose, but they have grown obsolete under the more advanced methods of providing dental education and should give way

to the newer administrative personnel and field force with adequate clerical assistance. Full-time instructors are available to teach the correlated subjects without extra cost. Diversified courses in medicine and dentistry can be supplied in such number that losses in some can be balanced with profits in others. It is not always necessary to expect certain branches to pay their way, as state appropriations and budgets would cover a reasonable amount of deficiencies for the good of the cause.

Dental societies have been striving to meet the need by earnestly conducting short courses of instruction at their meetings, but such measures, despite their emergency value, are superficial and inadequate. Only partially trained and experienced men, who usually change with each succeeding administration, serve on the program committees. There is unavoidably a large loss of time, and general conditions make it difficult, if not wholly impossible, for the lecturers and clinicians to leave the proper understanding and technical knowledge of their subject in the minds of their audiences. Only too frequently we see more damage than good brought about as the result of it.

The extension course, which has recently been introduced in Oklahoma through the cooperation of the State Dental Society, State Health Department, and the Extension Division of the State University, is a great improvement over the older methods. A special itinerant course of instruction in children's dentistry involving six weeks, of one afternoon and evening a week, and another in general dentistry using the same amount of time, were given. This is equivalent to a continuous course of one week. Eight of the best instructors, including Dr. Arthur Black, Dean of Northwestern University, presented the courses. The fees were $25 and $40 respectively, with practically no loss of time or additional expense to the applicants. These courses were considered a real success.

The general adoption of this plan would relieve the societies of a large and unnecessary burden and permit the organizations to give more attention to the general business affairs of dentistry which are constantly increasing in number and importance. They, unfortunately, have had little interest and attention. This type of extension course, because of the unavoidable brevity, would not provide sufficient training for the exclusive practice of any of the specialties on a properly standardized basis unless it be made progressive.

Under present conditions any dentist may publicly announce himself as a specialist, and superior to general practitioners in particular lines of oral health service, without having to submit to any special educational requirements or demonstrate to an examining board the validity of his claims. In dentistry as in medicine there is an increasing tendency for men to become specialists without proper preparation. Unrestricted abuses of this privilege, even though they are made by honest effort, threaten to destroy public and professional confidence to a degree that will stunt dental progress.

The obligation of the universities to provide a systematic curriculum for the training of specialists in orthodontia and in other types of oral health service is clear and urgent. Dr. Gries recommends, and many other leading educators agree, that education for the practice of the specialties should

come only through a combined medicodental curriculum equal in length and character to such as is offered to candidates for higher degrees. The present five-year undergraduate course, as some have suggested, might be reduced to four by increasing the annual term to eleven months. The present three months' vacation period for professional training appears to require an unnecessary amount of time and money. Preparation for specialization could begin by majoring in the undergraduate study to determine one's aptitude. The addition of an optional full year, graduate curriculum, based upon the undergraduate curriculum and conducted on a high plane of scholastic quality for systematic and intensive training in orthodontia and other types of oral specialization, should have a commensurate degree of M.S. After this is firmly established, an additional year embracing further study and attainments in research should lead to a Ph.D. Statutory preparation could actually begin the year following the attainment of a D.D.S. degree or later. Ample opportunity could further be provided by offering the course in sections, or in part, by extension service.

While several of the most prominent universities of the country have made an earnest effort to establish this course of training, they are having a hard struggle for several reasons. Organized dentistry including the special branches has failed to give them proper publicity. The limited obligation of state universities to state jurisdictional policies is another reason. The competitive influence of the proprietary schools is still another. The profession en masse is unaware and has so far failed to realize and appreciate the true significance of the new standard, which is being only too slowly established.

The advanced standards cannot be developed without increased financial support, but with proper professional support and additional adequate resources the most important dental schools could promptly effect the proposed improvements.

Although dentistry is an important mode of universal health service, the public has done little to advance it. Endowments and state aid for the establishment and maintenance of the best of schools is urgently needed in the public interest. In this important aspect dental education is identical with medical education, but hitherto in an era known for its generous financial support deservedly accorded medicine, the educational facilities and research needed for the advancement of oral health service have been almost wholly ignored. It is, however, gratifying to observe that there are numerous philanthropists and university authorities who appreciate the true value of such laudable undertakings and are prepared and willing to lend a helping hand if they are properly approached and assisted. The public has come to realize that dental health occupies a very important place in our economic, social, and moral structure and is willing that a fair portion of the public funds be invested in dental education, just as it is in our state schools of medicine, law, journalism and others. It is the duty of organized dentistry to divert more of its time and energies to the business of elevating and safeguarding its educational standards and assist in the promotion of research.

While dentistry and orthodontia have made remarkable progress in the development of mechanical agencies for restorative work, they have been baffled by pathologic causes and their removal and control. The tendency to irregular alignment in dentition and facial deformities appears to be growing; decay of teeth is rampant, and the loss of teeth owing to disease of their investing tissues was never more common. The avenues for dental research are wide and numerous. It would be interesting and valuable to know the types of oral abnormalities that are directly influenced by heredity. I believe it is safe to assume that one of the next great advancements for the prevention of disease and mental and physical cripples must come through a better appreciation of eugenics and a closer understanding of the laws of inheritance.

The recent establishment of the American Board of Orthodontia, which is patterned after the Board of Ophthalmology and others of a similar kind is a most commendable and worthy undertaking. It is sure to have a stimulating effect upon higher education in the ranks of orthodontists by way of professional distinction in the orthodontia field, but will probably have little effect in regulating the qualifications for admittance to the specialty. After it is once established, it should be the further ambition of the American Society of Orthodontia board to legalize it in order that it might serve its purpose more completely. By making it a national examining board by process of legislation, it would have the power of enforcing the desired qualifications for practice. Without this power of enforcement, if it be fair to judge its probable achievemvents in this direction by the influence of the other similar organizations, it will have relatively little effect upon raising the educational requirements for the exclusive practice of orthodontia. Distinctive requirements by law for the exclusive practice of orthodontia would in no way interfere with the dental practitioner who desired to use it in the general routine of practice.

Dentistry has been so engrossed in the mechanics of practice that it has neglected many of its public and professional obligations, which might be classed as public and professional business.

The recent concerted and partially successful effort to lower the professional dignity and prestige of orthodontia by legislation, which would place it in the same professional classification as chiropodists, chiropractors and the like, by establishing a three-year course of special instruction without first obtaining a dental degree, and was put over unchallenged before the legislature of Arizona, should be a good object lesson to our orthodontia societies, which stand for the better things. When such impractical dental laws are enacted without resistance, is it not reasonable to assume that more constructive types might be had if they were introduced and supported by the whole profession?

The problem of fulfilling our public obligations in the work of prevention, which must come from research in universities and of supplying qualified orthodontists to meet the requirements of public service is a serious and difficult problem. Public enlightenment and demand for the best of medico-dental service is going forward at such a broad and rapid pace through vari-

ous educational channels, that our principal difficulty is to keep the profession in the procession. Soon after launching our educational program for the laity in Oklahoma it became necessary to check our operations and to formulate a program of educational work for the profession in order to keep our activities properly balanced.

For example, hundreds of parents over the state were taking their children to dental offices for corrective work, with a definite knowledge of the kind of advice and remedial work they should receive. It is the business and duty of all official and nonofficial health organizations to teach and enforce the fundamental rules and laws of health that are recognized as scientifically sound and of practical value. When the official state health organization instructs the parents and children through educational mediums, that the smallest cavity should be filled, that all chronically infected teeth should be removed, and that malocclusion should be treated during the transitional period of dentition, and that certain other corrective and preventive work is indicated to safeguard the health of the child, and then to have false advice or faulty corrective work of the practitioner run counter to the recommendations of the department, the applicant naturally loses confidence in dentistry. The State Health Department is rightly considered an authoritative agency in the regulation of public health measures, and when the profession fails to keep itself properly informed along the more advanced scientific lines of preventive and reconstructive health service, it handicaps educational progress. We now have under preparation a set of rules for the guidance of practitioners doing children's dentistry.

The responsibilities for dental health education of the public should be vested in public health authorities and public educational institutions. It is an important public welfare work and should be done largely at public expense. Dental societies are only in a position to do a small portion of it. They should be concerned mostly in the development of research to discover more effective methods of cure and control. Also to study ways and means of introducing and causing the discoveries of science to become operative through the different health agencies by establishing closer contacts. Orthodontia education should be recognized as an integral part of all dental health programs and carried forward as a unit in the general scheme of health education. The ultimate success of a general health program is dependent upon a properly balanced relationship of all branches of the healing art. It would be very desirable to have a standing committee on orthodontia education in the Southwestern Society to assist the bureaus in the several states in preparing the proper kind of educational material. The establishment of a bureau of dental health education in the State Health Department makes it possible to meet on a common ground with all the various organizations that are interested in the advancement of health education. It makes it possible to open up many avenues that would otherwise be closed. Dental health education has found its way into the activities of the Oklahoma Public Health Association, Oklahoma Crippled Children's Society, Oklahoma Educational Association, Oklahoma Dental Society, Parent Teachers' Association, County Health Units, Red Cross, Bureau of Maternity and Infancy, Oklahoma Medi-

cal School and Hospital, Oklahoma University and others. It has everywhere received sympathetic support and discovered many opportunities to make further advances with liberal financial support. The bureaus of dental health and of maternity and infancy are by far the most popular departments, and dental health has an important place in the latter. A booklet on dental health for mother and child is sent every expectant mother. The physicians cooperate splendidly as provided by law in reporting their cases. It is plainly evident that philanthropic assistance and public funds could be made available with the proper kind of an appeal and guarantees of honest, efficient management.

We have just recently made application to the Rosenwald Foundation for funds to establish some research and demonstration clinics for children that will operate on a low fee for the low wage earner. The Extension Division of Education of the State University will manage it as a part of the educational program.

The faster and more completely these special classes of work are introduced and established in our large institutions, the greater will be our educational achievements. It is to these institutions where they have efficient boards of administration that we should go with our educational problems for assistance. They were established in the interest of education by the public for the public at public expense in so far as education can be provided on a sound and practical economic basis.

Special appropriations, while highly desirable, are not always so necessary as many think to carry on this special research and educational work. Many of the universities have sufficient funds in the budget to allow their full-time medical instructors to engage in research. All that is needed is to arouse their interest and to give them the proper cooperation. Research is their hobby, and an important part of their life's work, as their reputation and command of salaries are largely dependent upon their achievements in the line of research. It does not diminish their incomes, on the other hand, it increases them. These men, if you will observe, are anxious to venture into new and unexplored fields for a new thrill. The private practitioners have neither time nor facilities to do very much without medical assistance.

Dental health education in its public relations must necessarily embrace all phases of dentistry if it is to render the maximum service at the minimum cost. The success of one branch of the work is dependent upon others, and the work must be so molded as to fit into the general plan of our political, social, and economic structure. Scientific research to provide more effective means of prevention and cure undoubtedly is our greatest need. In this work we can act only as a directing agency, since no appropriations are made to the State Department of Health for research. The general program includes education of dentists to the importance of etiology, diagnosis, prognosis and methods of treatment.

1. Directing parental attention to the importance of prophylactic dentistry.

2. Establishing dental health clinics for low wage earners and indigent cases.

3. Bringing the attention of public officials to the economic value of mouth hygiene service.

4. Introducing curative dental service in state hospitals and penal institutions.

5. Cooperating with the medical profession and getting curative dental health service to function effectively in hospitals.

6. Directing employment of dental hygienists and dentists who are qualified to establish clinics and dental health programs in school systems, large industries and in supervising research and demonstration clinics.

7. Providing low pay and free dental dispensaries in connection with public charities.

The business of supplying dental health service to the public is a stupendous and difficult task. Statistics indicate that about 80 per cent of our families have an income of not more than $2,000 per annum. It can be reasonably assumed by our investigations and others that about 85 per cent of the children have defective teeth, while 50 per cent have anomalous dentures and about 30 per cent have conspicuous and extreme oral malformations which would seriously affect normal health and development.

It is, therefore, obvious that adequate corrective service, even though it comes within the range of the more inexpensive lines of general dental service, is not accessible to the vast majority of our people if the private practitioners are to be compensated properly.

Remedial orthodontia service on account of the time and expense involved in treatment is far beyond the reach of another large percentage of the families and cannot be made available unless the responsibility is placed on public or endowed institutions.

There are, however, possibilities of putting it within reach of a much greater percentage of the people if we would make a serious effort to solve the problem.

Dental orthopedic clinics should operate more extensively in dental colleges and should certainly have a place in all the hospitals for crippled children in the country. A more careful study of modern business methods, as they apply to orthodontia practice, would make an extension of service possible in many places.

One, two, or three orthodontists by a copartnership arrangement could buy or construct a combination building, of a style that could be easily remodeled into a general business building in the line of the city's growth and development to get the appreciation on their realty investment, which would greatly reduce or eliminate rents. Less expensive equipment could be provided. An orthodontist who desired further experience and training before entering private practice could be employed on a straight salary or on net percentage or on a combination of both. Prophylaxis in orthodontia, which must be given at each visit, utilizes an astonishing amount of time. This work could be transferred to a dental hygienist. An efficient and honest secretary and a competent technician might be made available to make appliances as directed. An assignment of various duties to others capable of performing them would reduce to a low cost everything except the essentials, such as

diagnosis and treatment. The private practitioner could then send those unable to meet his regular fee scale to the clinic where a lower fee scale would be operating. A large number would find their way to the clinic through the dental profession and other ways of approach. A fair and reasonably accurate check-up could be made of their worthiness for admittance through Credit Men's Association and other means of investigation.

The extension of time between visits to the maximum, consistent with safe and efficient service to reduce working time to the minimum, would further allow for a much larger volume for a mass production basis.

The loss of time and the crowded hours of practice, which is an economic waste due to the thoughtless and overzealous sentiment of school attendance as it relates to the welfare of children deserve consideration. This obstacle might be greatly reduced by impressing parents, teachers, principals, and school authorities with the importance of children's receiving preventive and corrective orthodontic service without being penalized for their absence. The necessary rules regulating school attendance must be duly recognized, but when they interfere with the child's future well-being, they should be modified to a degree that will allow reasonable opportunity for treatment. Health is considered of first importance in education, and school authorities will make any reasonable concessions that seem warranted, if they can have the proper assurances that the privilege will not be abused. Many superintendents of schools will issue a special bulletin authorizing principals and teachers to allow full credit for attendance, without any penalty, upon written excuses from the orthodontist covering the child's absence.

An efficient office arrangement and strict adherence to sound business principles of practice should be other essentials. The same principles are likewise applicable to the general conduct of a private practice. This plan should in no way interfere with the man in private practice, who should have a full and unrestricted opportunity to increase his fees in relative proportion to the number of people who want to purchase his services and are rated higher than the clinic will admit.

These suggestions might be helpful in solving the economic problem of medicodental service with which we have recently been confronted by public opinion. They furthermore may have a tendency to elevate the present-day standards of specialized training, which are so badly in need of attention.

# A TELEOLOGIC VIEW OF ORTHODONTIA*

By F. J. Reichmann, D.D.S., Oklahoma City, Okla.

THE object of this discussion is to suggest a thought sequence which might aid us in a small way to appreciate our wonderful present, with its many possibilities for future advancement. The diagnosis of any particular defect is not attempted, but it is hoped that some of the concepts presented will result in a rational judgment of our present situation. The views of a general practitioner must necessarily not touch your specific orthodontic problems in an intimate way, but rather discuss your impediments to further development as they are related to the entire profession and to society at large.

At the present time dentistry is considered to be in a quite satisfactory situation. We have won and retained the respect of the people; our future progress depends upon keeping and increasing this respect. This may be done by constantly readapting ourselves to the social progress of society, fulfilling its requirements for dental service and constantly striving for the ideal of perfect dental health for all. We are winning our place as a learned profession, in relation to both education and medicine. Surely much is to be accomplished yet; we must weave ourselves into the educational system so that the students of dentistry may obtain the same recognition that is given to students in other educational departments having the same high standards. We cannot legislate and demand this favor; it will come when we prove our right to it.

One of the weak points of dental education is that we have been expending a large proportion of our energy in devising means of caring for the wealthy class. This has been a natural result of the highly technical nature of our work. The past does not control the future, however, and even at the present time an appreciation of the problem of dentistry for all is a strong factor in our behavior. This is a social and economic problem, the force of which will increase rapidly within the next decade. We are a part of the social scheme, and when we have taught society to demand dental service as a necessity, we must be prepared to deliver that service to everyone. If we fail in this, our profession will be thrown into competition with new professions that profess to fill this need.

During the past decade dentistry's ability to serve the people has increased considerably, yet on every hand we see indications that we are just beginning to fulfill our mission to society. As we prove our ability, society places a value on our work, and it becomes a necessity. In education and medicine, society has determined a minimum service to which every person is entitled. Even now there is a dental minimum which must be given to each

*Read at the tenth annual meeting of the Southwestern Society of Orthodontists, Oklahoma City, Okla., February 25, 1930.

in need of that service. In Oklahoma, and many other states, all children who are handicapped physically are given corrective treatment by the state. The dental cripple also is entitled to service to correct that defect; a minimum of orthodontic service is being established. Dentistry expects the orthodontists to meet that minimum and provide for a means of continuing to meet it in the future.

Dentistry's educational problem, like all others, is constantly changing, sometimes difficult and bewildering. Professional education must be sound, conservative, and fundamentally correct, so it must lag behind the pioneers. Time is the only reliable judge that separates the prophet from the fanatic, so education must follow the wiser radicals of yesterday rather than the untried radicals of today. Knowing these things, our educators have required their students to delve thoroughly into the fundamental sciences. By having a thorough and broad basic training the student can select the best of the new methods and apply them in a scientific way. Whatever is wrong with dental education, it is not overburdened with training in the basic sciences.

It is very gratifying to notice that every branch of dentistry is anxious to obtain more time in the undergraduate curriculum. Realizing that the time is limited, most departments are content to teach the student the fundamental principles, enough technic to care for the simpler cases, and offer him postgraduate work if he desires it. This method works quite satisfactorily in those departments having trained teachers who understand its limitations. Of course its success is predicated on the assumption that the specialist is intended to care for the more difficult cases.

The current tendencies in orthodontic education have their origin in the history of its development. Orthodontia is not a true science, since its basic principles, its problems, and its future are linked with medicine and dentistry; it has been secluded from dentistry to such an extent that the general practitioner knows almost nothing about it. This is a special educational problem which has been produced by passive inaction. You have been content with private "intensive courses" instead of demanding suitable recognition on the college faculties. Not having developed your postgraduate work in conjunction with dental colleges has made it possible for orthodontia to be little more than a stranger to thousands of graduates. Building a specialty upon the ignorance of the general practitioner is basically unsound; if it were not for the direct appeal of your work to the esthetic sense of the people, it would have been impossible.

It is obvious that the present unstable condition of orthodontic education is untenable, and a change is indicated. No phase of education should be a settled fact, for settled products of the mind build exclamation points, but never cultivate question marks. We need to question our educational methods and to change them when real improvement can be attained. Our problem is to seek constantly those laws and regulations which are for the common good, not of any one specialty, but of the entire profession and society at large.

A suggestion for a change in our educational system has received considerable publicity during the past year. As I understand the plan, it would

attempt to prepare a student for the specialty of orthodontia during his undergraduate years and prohibit him by law from practicing general dentistry. He would be an orthodontist but not a dentist; he would not be a specialist. He would be in a situation the parallel of which cannot be found in the history of medicine or dentistry. Surely such a new departure in dental pedagogy is worthy of serious thought by the entire profession before being placed in effect. To my knowledge this has not been the policy of those who are partial to this new method; they have adopted secrecy and political manipulation as their allies. The literature does not reveal the basic reason behind this move; nor has there been an explanation of the virtues of the method of its introduction.

The general practitioner believes such methods of changing our present system are wrong; therefore he is against the change until its value is demonstrated. Can a law be written and enforced which defines orthodontia so clearly that it may be held separate from dentistry without handicapping both orthodontist and general practitioner? How many students know they are adapted to orthodontia, and know they will be happy practicing it? Who can predict the future of orthodontia and tell at this time what knowledge of dentistry will not be of great value to the orthodontist ten years from now? How can we prevent other specialties from seeking the same favors? If they are granted, will we not have groups of "specialists" who do not understand one another; "specialists" who choose their specialty during their adolescent years when they do not have enough experience to choose? These and many other questions must be satisfactorily answered before we should adopt this type of change. We must not just change because we think a change is indicated.

Those who have teleologic minds realize that such propositions are the products of unrest and dissatisfaction with the present order. They sense that orthodontia has been progressing in the wrong direction, not abreast of the times, or is about to make an important change of policy for some other reason. They will study every angle of the condition, gather all the facts available, and make an estimate of the situation; then they will recommend and apply directional forces which will cause the inevitable changes to be evolutionary, developmental, and progressive, not involutionary, detrimental, and retrogressive. They will call in specially trained minds to help solve each problem as it appears; educators, economists, sociologists, and all other students of our complex social scheme will be consulted. They will plan for a future world, not just strive to satisfy the conditions of the fleeting present.

All of these discussions, plans, and proposed changes are in themselves helpful things. They indicate a willingness to think in terms of the future. Do not think that I would blindly champion the present order, make education a "bed of Procrustes," or in any way seek to limit freedom of thought. Any drastic change should, however, evolve slowly, be guided by past experience, and be activated only after being adjusted most carefully to the allied professions, the educational system, and the social order.

The most important problem before us today is the social problem. If we think only of our profession, we must expect chaos to result. In the last

analysis we must fill our place in the social scheme to the complete satisfaction of society or we shall be dismembered and dissolved. If, however, our basic thought is for human welfare, our profession shall progress beyond our present imagination. We must constantly seek to replenish our ranks from those who desire to serve society; service must come before profit. This "career motive" individual can be attracted by our profession if we demonstrate our ability to satisfy that desire.

In conclusion I wish to congratulate you. You are beginning to think in terms of the future. When you also begin to think in terms of society, your thoughts will grow into a happy solution of your problems. I have not brought you any suggestions of policy, one more would only cloud the real issue. It is frequently said that specialists are narrow-minded, thinking only of their own work. Disprove this misconception of the highly trained mind. Profit by the lessons of life. What is more pitiful than to read the childish remarks of a great inventor on college education, or a very successful manufacturer on sociology? Your problems carry you away from your specialty; demonstrate your faith in specialization by consulting those minds which are trained to solve them.

# LABIAL DEFORMITIES DUE TO MALOCCLUSION*

By Dr. Rudolph Schwarz, Basle, Switzerland
*Professor of Orthodontia, Dental Institute of Basle, Switzerland*

THE simplest way of showing how malocclusion causes a disfigurement of the face, and of the lips in particular, is by means of photography. We merely have to take the profile view of the patient and place it in juxtaposition to a view of the plaster cast of the jaw. Unfortunately this procedure fails to explain the manner in which the lips are related to the jaws and teeth. An attempt has therefore been made to insert into the photograph of the profile a photograph of the jaws in occlusion.[1] However, this method, too, cannot be accurate, owing to the distortions of the photographic picture. We would seem to attain to a higher degree of accuracy if we succeed in taking an x-ray view of the head in which the fleshy parts are also visible. A procedure of this kind has been evolved by Devey, Riesner and Simpson.[2] The drawback is, that if the contours of the face do become visible, then the bones do not appear distinctly enough. I have succeeded in obviating this drawback by spreading, with a paint brush, a bismuth paste on the profile. This coating of bismuth shows sufficiently on the negative; with a sharp needle-point the line is traced over a film-viewing box so that the profile appears on the copy in bold outline (Fig. 1, section 5). The x-ray view, unfortunately, rather distorts the proportions, even though the tube is placed at one meter from the median plane of the head; the view, therefore, cannot supply accurate measurements.

Up to the present the relation of the jaws and teeth to the lips was accessible to observation and measurement from dead bodies only. However, the number of available preparations is small, so that the textbooks of anthropology and orthodontia are all found to present the same schematic representation of the lips and teeth. With all that, the variations of the lips, not only from the point of view of their relation to the teeth, are numerous and manifold. In order to supply facilities for examining these relations on copious biometrical data, I have elaborated a procedure enabling us to copy, accurately and directly from the life, the correlation between the lips and the jaws in the projection on the median sagittal plane.

Take a plaster impression of the maxilla. On to the guiding pins of the impression tray, fix my face bow with which to determine the ear-eye plane and the two profile points, nasion and subnasal point (Fig. 1, section 1). Along with the plaster impression of the mandibular teeth, an impression of the chin is obtained, by means of a chin cap filled with plaster (Fig. 1, section 2).[3] On the person to be measured, mark the points nasion, subnasal and gnathion with an indelible pencil, and then take the measurements. Now cover the whole profile with a strip of plaster, which, beginning at the hair limit, completely

*Read at the Congress of the European Orthodontological Society.

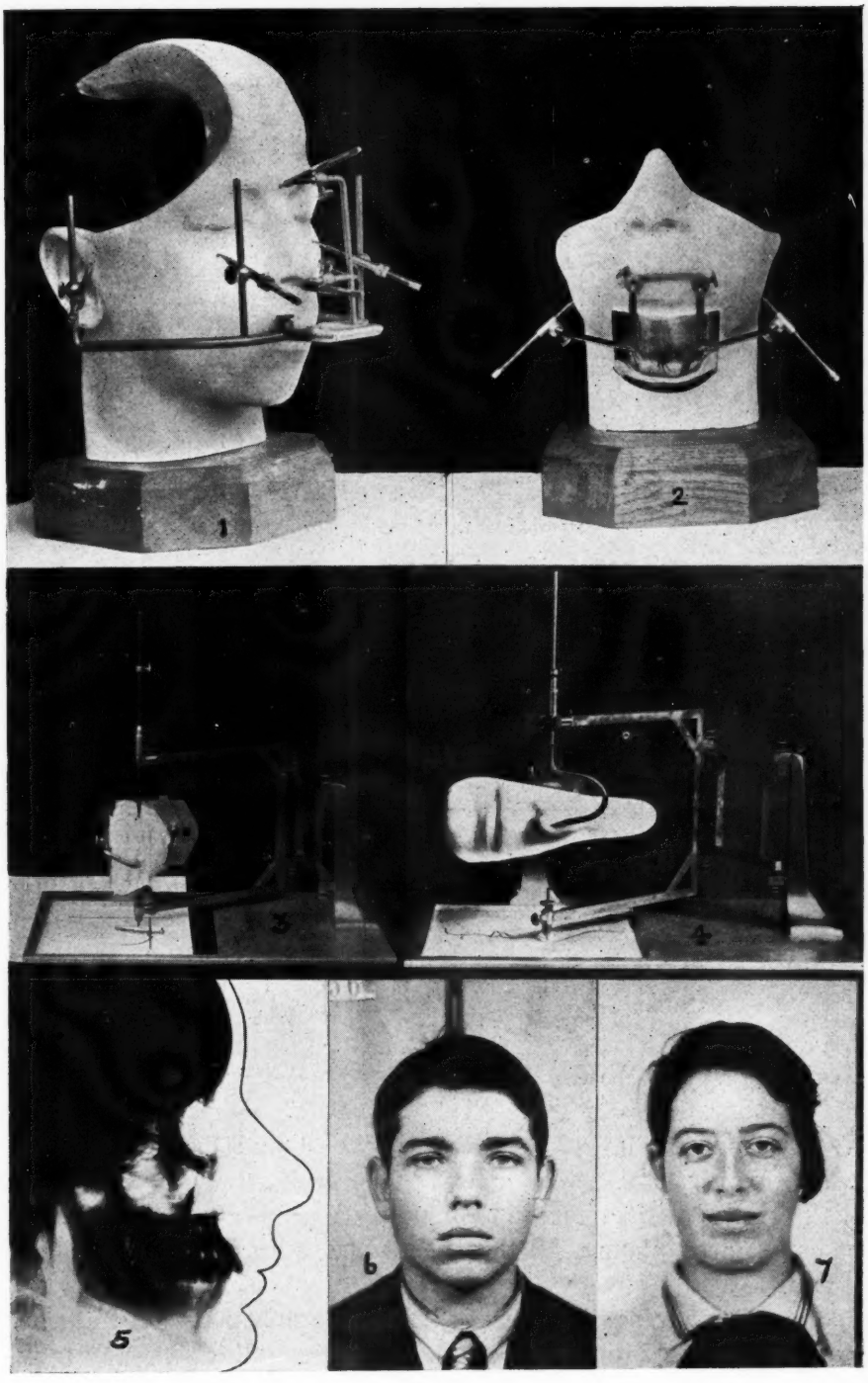



Fig. 1.

covers the nose and mouth and extends to below the chin. Into this mould, the plaster is then cast, and we thus obtain an accurate profile with a complete reproduction of the nose and the mouth.

### GRAPHIC REPRESENTATION

In order to represent the relation between the lips and the jaws I employ geometrical drawing, which makes it possible to measure exactly the absolute and true dimensions including the thickness of the lips. With my small stereograph the jaw models in occlusion are inserted into the median sagittal plane, and projected on to a sheet of paper, after which the profile points obtained with the aid of the face bow—nasion, subnasal point, and gnathion—are entered on the drawing (Fig. 1, section 3). Now with the help of a special profile holder in the drawing apparatus, the plaster profile is also inserted into the

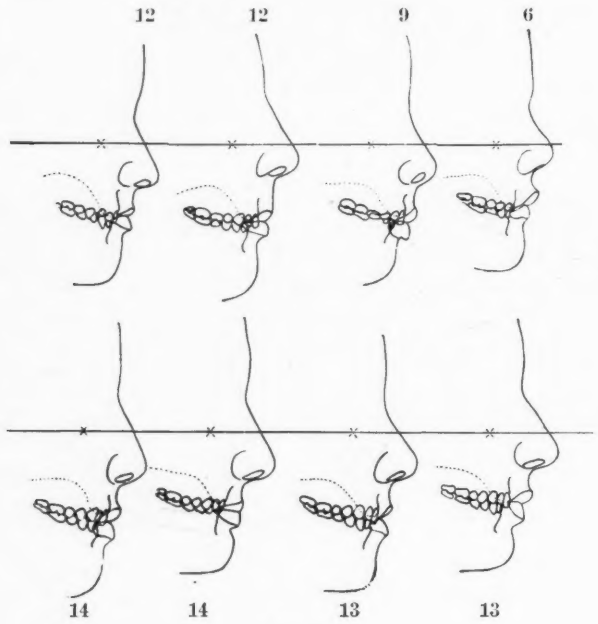



Fig. 2.

median sagittal plane, to be drawn on another sheet of paper with the help of a bent needle (Fig. 1, section 4). Next, this drawing is superposed with the first drawing showing the points nasion, subnasal and gnathion, and traced through. In this way Fig. 2 was made, which furnishes a complete representation of the thickness of the lips and their position relative to the jaws and teeth, in the median sagittal plane. All these illustrations have the ear-eye horizontal for their base.

Supposing there is available a profile photograph made on anthropologic principles, it can be used in the place of the plaster profile. The way to proceed is as follows: project the negative on to a screen by means of a projecting lantern. As a scale corresponding to the median sagittal plane of the head is photographed along with the face itself, the picture can easily be reduced to natural life size. Now pin the drawing of the jaw models on to the screen and superpose the profile points—nasion, subnasal, and gnathion—on the correspond-


Fig. 3.

ing points of the photograph; this superposition usually comes off quite successfully. The profile of the photograph is then traced on the paper, and also the shape of the lips. The real profile line in the median sagittal plane cannot be hit unless the middle of the object glass is made to coincide with this line; that is not the case in views of the head.

In our study of lip deformities through malocclusion, we shall proceed according to the classification by Angle. First of all, however, we shall consider conditions characteristic of normal occlusion.

### THE POSITION OF THE LIPS RELATIVE TO THE TEETH IN NORMAL OCCLUSION

The shape of the fleshy parts of the oral region depends in the first place on the shape of the alveolar processes and of the teeth. Over and above this, however, the formation of the lips is influenced by the factors of race and

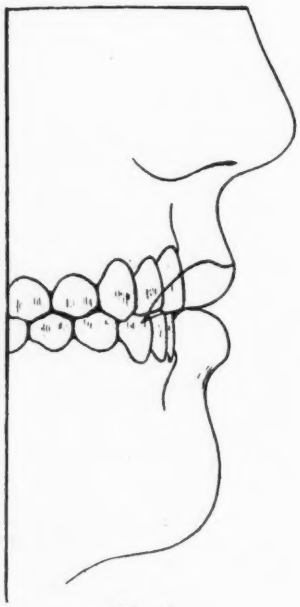


Fig. 4.

constitutional type. The point in question therefore is: does an anatomically correct or normal occlusion of the teeth naturally cause a harmonious form of the lips? O. Meyer has examined 2,066 sets of teeth of Basle children from four to seventeen years of age; of these, 149, i.e., 7.2 per cent were found to show a normal occlusion. Of these test subjects jaw impressions were taken in conformity with my measuring method.[4] At the same time a photographic anthropologic view was taken of each child. Now this photographic material presents a multitude of variations in the mouths. Anthropology distinguishes, with regard to the profile contour of the median part of the integumentary upper lip, orthocheilia, procheilia and opisthocheilia. Orthocheilia means that, with the head adjusted to the ear-eye horizontal, the contour of the profile is approximately perpendicular; in the case of procheilia it slants forward; in the case of opisthocheilia it slants backward. Although in our population orthocheilia predominates, there are some cases of slight procheilia (Fig. 3, sections 1, 2). Even opisthocheilia, otherwise to be found only in females of northern


Fig. 5.

races, I have observed in four cases of Basle children. This formation appears to be determined by the constitution; for according to Kretschmer[5] the face type of the asthenian (leptosom) is characterized by an angular profile: the upper half of the facial contour slants forward along the ridge of the nose, which is the dominant feature, to the tip of the nose, and then recedes again down to the chin. The frontal view shows a shortened egg shape. This asthenian face type is very marked in four children (Fig. 3, sections 3, 4, 6). In the case of 5 the lips would seem to suggest malocclusion; for it is this profile contour that we meet with in the case of distocclusion (Angle, Class II, Division 1). One even finds children who cannot close their mouths in spite of normal occlusion (Fig. 3, sections 7, 8).

The normal relation of the lips to the teeth was established in a schematic arrangement by C. Case, who studied the dentofacial irregularities on hundreds of plaster masks (Fig. 4). The upper lip covers the maxillary front teeth, the lower lip the mandibular teeth; the projection of the angle of the mouth falls on the mandibular canine tooth. We have drawn, in the manner described above, a number of profiles from children with normal occlusion, and the result of the comparison is that each case presents a different aspect. Hence it is difficult to establish a normal type. The line of the mouth, as seen in profile, may run parallel with the ear-eye plane, or it may rise slightly; more often it droops. The upper and the lower mucous lips may be of the same width, or the upper red lip may appear only as a narrow line. Also the thickness of the integumentary and the mucous lips varies greatly. The exact measurements can be obtained from drawings (Fig. 4). Two cases of very high lips appear on Fig. 1, sections 6, 7.

The mentolabial sulcus also presents manifold variations. The aperture of the mouth in normal occlusion, according to O. Meyer, varies from 32 to 50 mm.

### LIP DEFORMITIES IN ANGLE CLASS I (NEUTROCLUSION)

Although in Class I the jaws are in correct mesiodistal relation, the features of the lips may be deformed by anomalous positions of individual teeth in the front rows. If the canine tooth stands in the labial occlusion, the upper lip above this tooth bulges a little; the upper lip may even protrude completely (Fig. 5, section 1). On the other hand, a labial occlusion of the mandibular front teeth causes the protrusion of the lower lip (Fig. 5, section 2).

### LIP DEFORMITIES IN ANGLE CLASS II (DISTOCLUSION)

*First Section.*—The mandible and the lower dental arch, in their relation to the maxilla, are in distal displacement. The upper dental arch is often narrowed, the incisors protruding, which causes various deformities of the lips. The position of the lips in these cases of malocclusion is not consistently the same. In the majority of cases, to be sure, the lower lip does reach and lie on the labial surface of the maxillary teeth when the mouth is shut, and it is drawn forward although the mandible recedes. Some of these profiles therefore can hardly be said to produce an inharmonious effect. In some cases, however, the lower lip is taut and stretched forward, as in Fig. 5, sections 3, 4. If at the same time the case is one of deep bite, the lower lip will protrude somewhat,

especially if the sulcus below the lip is of considerable depth. The mouth then shows a pouting expression (Fig. 5, section 3). However, it may also be that the lower lip disappears under the upper owing to severe tension (Fig. 5, section 5). A considerable dislocation of the lower lip is produced if the lower lip, when the jaws are closed, fails to reach the maxillary teeth, as shown in Fig. 5, sections 6 and 7. The line of the mouth is drawn downward and the upper lip shows a sulcus, so that the red of the lip in profile view is hardly visible. In some cases the mouth in repose cannot be closed owing to heavy protrusion of the front teeth, which imparts an idiotic expression to the face (Fig. 6, section 4). The impossibility of closing the mouth is further found in cases of open-bite when the rows of teeth only meet on the last molars, or if in spite of this the mouth can be closed, the lips are in a taut condition (Fig. 5, section 8). It may also happen, however, that the maxillary central incisors rest on the lower lip, which is pressed behind the teeth (Fig. 5, section 9).

Case shows in his book a boy with a snoutlike formation of the mouth (Fig. 5, section 10). A case observed by myself of an extraordinary overdevelopment of the mouth and lips is shown in Fig. 6, sections 1, 2, 3, in a youth whose face I have moulded in negocoll (Poller). The width of the mouth amounts to 61 mm.; it is the widest mouth that I have so far measured. Extraordinary oral features are also to be noticed in Fig. 5, sections 11 and 12; a large part of the alveolar process is visible with the mouth in repose. The cause of this lies not so much in too short an upper lip as in an abnormally high maxilla, as proved by my measurements. A survey of the labial deformities and of the relation between the lips and the central incisors is presented in Figs. 7 and 8.

*Second Section.*—The malocclusions of this section are also characterized by a recession of the mandible; however, the maxillary front teeth incline lingually in retrusion, the consequence being that they usually cover the mandibular teeth completely. The harmony of the mouth in its relation to the rest of the face is somewhat impaired, though not nearly so much as in Section I. The form and position of the lips is very fair, seeing that the lower lip almost entirely covers the maxillary front teeth, thanks to their abnormal overbite (Fig. 5, section 13). Still, if only the central incisors stand in retrusion, while at the same time the maxilla protrudes heavily, the profile view will show the same sort of lip deformity as in Section I (Fig. 5, section 14). However, in these cases we observe a particularly thick lip (Fig. 9).

### LABIAL DEFORMITIES IN ANGLE CLASS III (MESIOCLUSION)

This class is characterized by a mesial displacement of the mandible, as expressed in the mesiodistal relation of the first molars. The lower lip protrudes in front of the upper lip, as shown by the projections on the median-sagittal plane, and is turned outward. The mandibular front teeth incline somewhat lingually and overlap with the maxillary incisors; or the bite may also be open in front. The position of the lips and the mandible, which is mostly a high one, causes a bulldog-like expression (Fig. 10). Fig. 5, section 15, shows a case of mesioclusion with mesial dislocation of the mandibular milk molars in a boy of 4 years, section 16 a case of mesioclusion in a girl of 6.

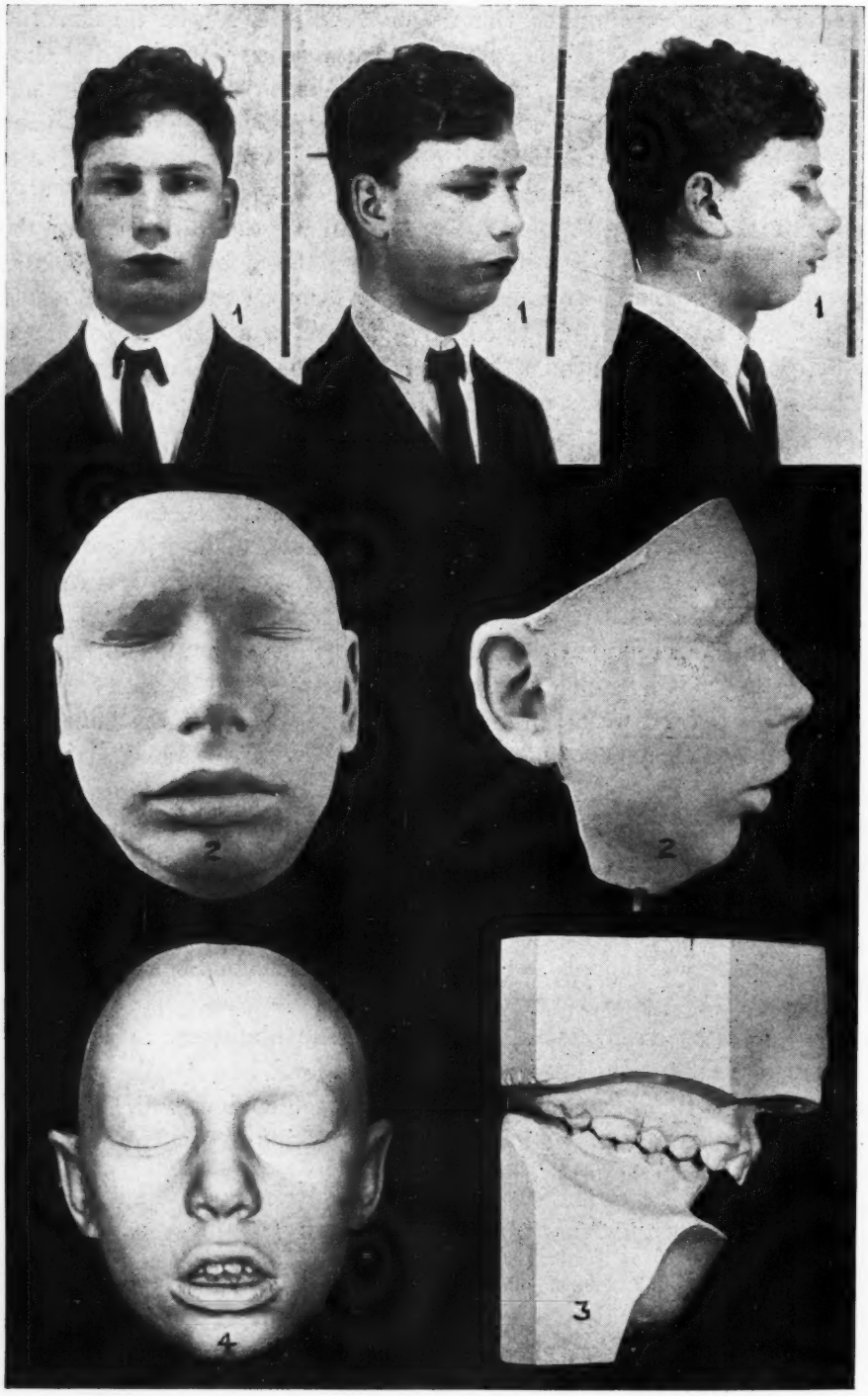



Fig. 6.

It has been asserted that the field of anatomy is completely exhausted. That is certainly not true of the lips. No figures are as yet available concerning the thickness of the integumentary and the mucous lips. The measuring procedure which I have suggested is intended as a contribution toward filling this gap; it will furnish the needed figures, after more copious materials have been collected and coordinated.

### PLASTIC CASTS WITH NEGOCOLL*

Dr. Poller of Vienna has, in the course of prolonged experiments, evolved a new modeling procedure, which offers many advantages over the methods employed hitherto. The new modeling material, called negocoll, is a hydro-

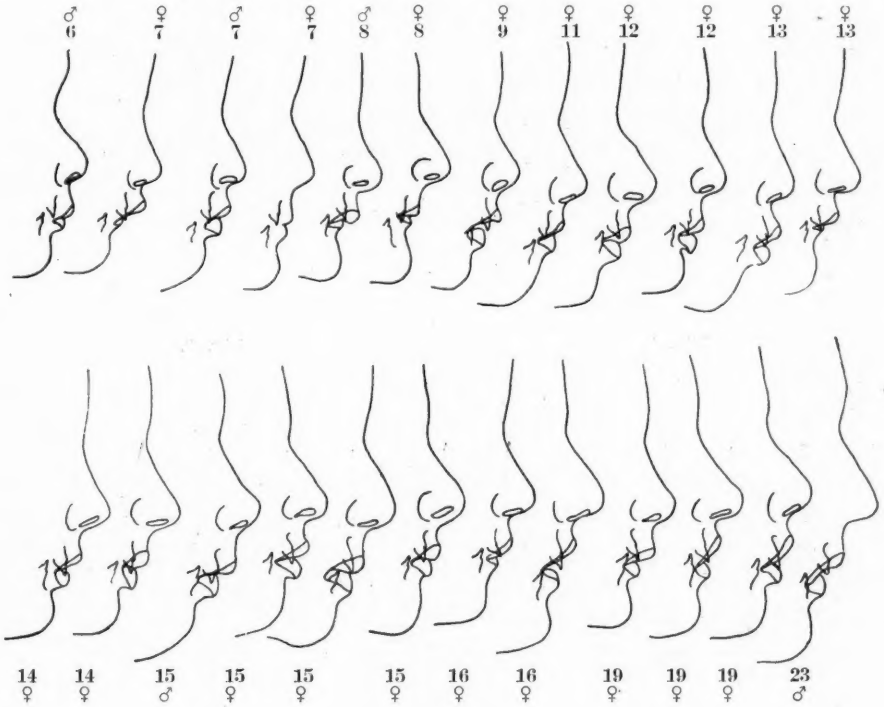



Fig. 7.

colloidal composition which, on cooling, solidifies immediately, while remaining elastic; hence it is particularly suitable for impressions from living subjects. I have tested the new procedure for casts of the face, and herewith beg leave to present my observations. Face-masks are of particular value to anthropologists and orthodontists; other parts of the body can, of course, be reproduced in the same manner.

The person whose face is to be modeled should be either seated on a chair, allowing the head to be bent slightly backward, or laid flat on a table. One and a half tins of negocoll have been got ready previously, the material having been cautiously heated in an enamel pan; during the process of melting, the mass has to be stirred without any intermission. After ten minutes the

*Solely made by Apotela, Ltd., Zürich, Switzerland; obtainable also Apotela, 65, Moorgate Street, London, E. C.

negocoll has cooled sufficiently to be spread on the subject. We let the mould extend to the hair border above and to the upper edge of the larynx below; at the sides, the ears are brought within the range of the cast. The negocoll is applied with a broad and heat-proof paint brush. First paint the ears, taking care to get the rims well covered; next paint the face, beginning at the forehead. Should the mass have cooled and condensed too much, it must be quickly heated afresh, whereon the work is continued until the layer is about 2 cm.

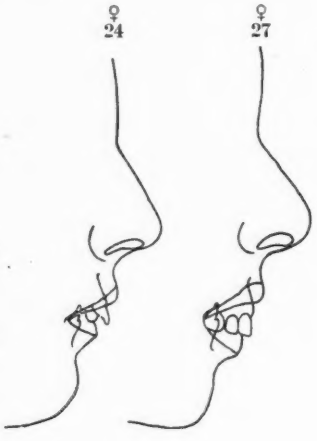



Fig. 8.

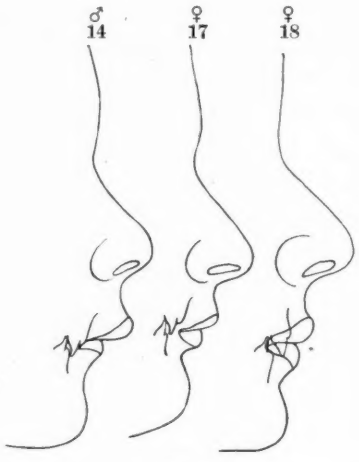



Fig. 9.

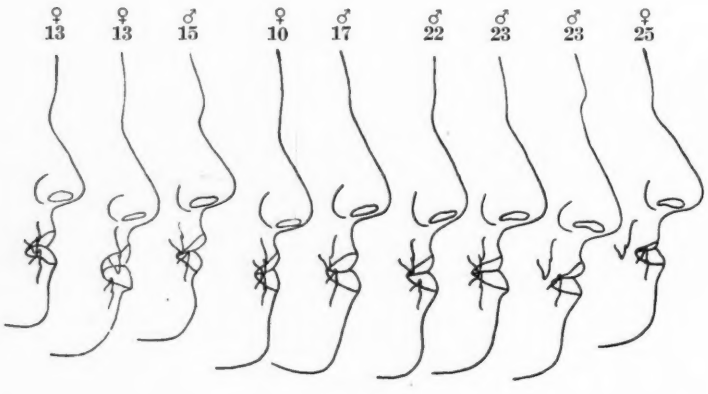



Fig. 10.

thick. Now I insert two wires, one shaped on the profile, the other across from one ear to the other. These wires are painted over too, so that they become firmly welded to the negocoll.

We can now proceed to detach the impression, after it has been well cooled off with cold cloths. We begin at the top of the forehead, a thin spatula being lightly passed along between the skin and the cast—any projecting fringes are cut off so that we obtain a smooth edge. This done, the ears are detached. As negocoll remains elastic, it can, if cautiously handled, be removed even from considerable undercuttings. The subject is requested to give a twitch of the features, whereon the whole mask can be lifted off.

The positive has to be cast without any loss of time, because the negocoll mould begins to shrink almost immediately. The preparations used for making the positives are called hominit and celerit. The light or cream-colored hominit is the most suitable for reproducing parts of the human body. Celerit, a shellac-like material, serves to reinforce the hominit positives. A few cubes of hominit are carefully heated in a small crucible over the flame of a Bunsen burner and slowly melted. Thereupon the mass is applied, with a small heat-proof brush, on to the mould. When the whole mould is covered by a thin layer, to reinforce it, strips, some 10 cm. long, single or double, of a bandage tissue are laid on criss-cross, and then painted over until the whole surface is reinforced. Now apply the last layer, the reinforcing celerit, which is prepared in the same way as the hominit. After the mass of the positive has cooled, the negative can easily be peeled off, and the mask is finished. All that may need to be done is to remove with a knife such slight unevennesses as may have been caused by air bubbles. The edges of the mask are also smoothed off with a knife.

It is this facility in making the positive that I consider the outstanding advantage of the procedure. Modeling with plaster of Paris is more difficult and takes more time. A plaster cast requires a great deal of subsequent retouching, and the subtle delicacies of the skin are not brought out in good relief. Whereas a plaster cast will soon lose its freshness, a hominit mask remains unimpaired. Moreover, as the mask is not more than 5 cm. thick, it is lighter and therefore easier to keep. Fig. 6, sections 2 and 4 show such masks. In one case I succeeded in moulding the teeth of a child who managed to keep his mouth slightly open—a good test of the possibilities offered by the new procedure (Fig. 6, section 4).

REFERENCES

1. Andersen, V.: Three Contributions to Orthodontological Diagnosis, INTERNAT. J. ORTHO., ORAL SURG. & RADIOG. **12**: 235, 1926.
2. Dewey and Riesner: A Radiograph Study of Facial Deformity, INTERNAT. J. ORTHO., ORAL SURG. & RADIOG. **14**: 261, 1928.
3. Schwarz, R.: Cephalometric Methods and Orthodontia, INTERNAT. J. ORTHO., ORAL SURG. & RADIOG. **12**: 1078, 1926.
4. Meyer, O.: Biometrische Untergerchungen der Anatomisch richtigen Okklusion, Dissertation, Basle, 1928.
5. Kretschmer, E.: Körberban und Charakter, Berlin, 1925, Lil. Springer.

# SOME CASES OF DELAYED ERUPTION OF THE TEETH*

By J. Lewin Payne, M.R.C.S., L.R.C.P., L.D.S., England

THE subject of eruption of the teeth has given rise to many speculations and theories, both as to the process itself and how it is brought about. Even today, in the twentieth century, we are not exactly clear as to what happens when a tooth moves from the position in which it was developed into that in which it can perform the function for which it is intended.

If we look back into early dental literature, we find a relatively large amount of space devoted to this question, which was dealt with under such titles as "Dentition," the "Breeding of Teeth," or as Thomas Berdmore described it—"The Sprouting of the Teeth." Yet in spite of all the literature that has been written and the many efforts of physiologists and histologists to explain the process, the mechanism by which teeth find their way into the correct position, and stop there, is far from being perfectly understood. It would seem that the most hopeful directions for seeking a clue are to be found in investigating the growth of the jaws, and the movements of teeth in the lower orders of the vertebrate kingdom and by comparing the effects of various pathologic conditions upon the manner in which teeth erupt.

I shall endeavor to guide your thoughts in the latter direction while describing some of my cases tonight.

It is not my intention to discuss the various theories that have been advanced to explain the eruption of the teeth, still less do I propose to put forward any new theory. My purpose is to demonstrate the results of some pathologic conditions, and to bring to your notice one remarkable series of cases, as well as some individual examples, in which delay has occurred in the eruption of the teeth. Others will be shown where the teeth have remained buried in the jaws and show no evidence of any attempt to reach the surface.

Let me begin by referring briefly to a few of the more common instances in which individual teeth fail to reach their proper levels in the alveolar arch at the normal time of eruption.

Some cases of delay may be due to mechanical causes. This view seems to be supported by the fact that the teeth which are most frequently late in eruption are those which meet with obstruction in finding their way into the arch.

For example, canine teeth have to travel some distance from the area where their development commences, and in order to reach their normal positions they must pass between the lateral incisor and the first premolar. Such obstruction frequently leads to displacement of the upper canine. The crown of the tooth becomes diverted and it may erupt, after some delay,

*Transactions of British Society for the Study of Orthodontics.

either on the buccal or on the palatal aspect of the arch; or, in some cases, the point of its cusp is turned toward the middle line, and the tooth remains lying almost horizontal to the alveolar border. Such cases are familiar to all dental surgeons. On rare occasions the canine has been found pointing into the nasal fossa, or beneath the chin.


Fig. 1.—Deeply placed right maxillary canine above a dilacerated and rarefied lateral incisor in a patient aged forty-six years.

Fig. 2.—A left mandibular second premolar lying unerupted with its apex close to the basilar border of the mandible in a patient aged forty-two years.

One could show many examples of retarded eruption in connection with canines, but I shall illustrate this point with one case only.

Fig. 1 shows a radiogram from a male aged forty-six, who presented himself with a sinus in the right upper canine region. A dilacerated and rarefied lateral incisor lay just beneath the surface of the jaw and the corresponding canine tooth was lying obliquely above it.

I would suggest, as a possible cause of this particular condition, that the

injury which caused the dilaceration of the lateral incisor diverted the canine tooth from its normal position and led it to move horizontally.

Second premolars are liable to meet with obstruction through having to erupt between teeth already in place; and even when the mechanical obstruction has been removed they may fail to erupt because absorption of the alveolus does not take place. Fig. 2 illustrates such a condition.

The presence of supernumerary teeth frequently delays the eruption of the normal members of the series.

Another type of mechanical obstruction is that found in the third molar region. This applies especially to the lower third molar, which, in consequence of lack of space between the second molar and the anterior border of the ascending ramus, remains impacted, or is often diverted from its normal course.

Even when the obstruction is removed by extraction of the second molar the buried member of the series may fail to erupt because alveolar absorption over the crown of the tooth is no longer active, but we all meet

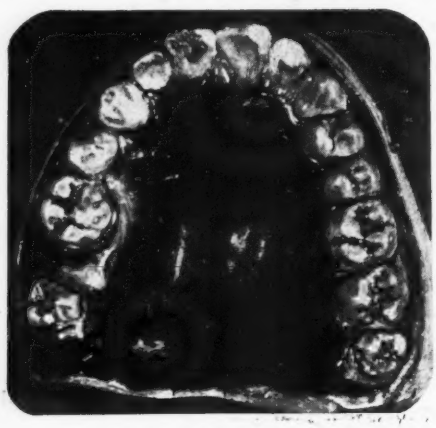


Fig. 3.

Fig. 4.

Fig. 3.—Model showing gap for unerupted right maxillary second molar.

Fig. 4.—Radiogram of case shown in Fig. 3 with the second molar wedged between the roots of the first and third molars.

with cases where the pressure of a denture seems to stimulate fresh activity, and to bring the tooth to the surface. Quite recently I have seen two such cases where the lower third molars were found erupting at the ages of sixty-five and seventy.

Now I pass on to some examples which represent less common conditions.

Fig. 3 shows the model, and Fig. 4 the radiogram, of a case of an upper second molar lying beneath the gum and wedged between the roots of the first and third molars. I have seen several cases of this nature.

The next example is one of peculiar interest, inasmuch as all the first molars lie deeply buried in the jaws. The patient (G. D.) was a boy aged thirteen. He was sent to me for consultation at the dental department of Guy's Hospital because of a swelling which could be felt below the mandible in the right molar region. It was a hard, localized swelling. On examination, the right lower first molar was observed to be missing from the mouth and no definite history of its extraction could be obtained from the patient.

(Fig. 5.) The other first molars could be seen, but they were incompletely erupted. The right mandibular second molar and the second premolar were tilted toward one another, and there was but a small interspace between their crowns.

Radiographic examination showed the first mandibular molar lying deeply buried between these teeth. It had a carious crown and a bent anterior

Fig. 5.—Shows the models of the mouth of G. D., aged thirteen years, whose first molars were all incompletely erupted.

Fig. 6.—(G. D.) Radiogram of the right side of the mandible showing the deeply buried first molar and an area of osteitis at the basilar border of the bone.

root. (Fig. 6.) This tooth was removed, under a general anesthetic, by cutting away a "window" of bone from the outer side of the jaw and by subsequently grasping the tooth with bayonet forceps.

Both roots of the tooth (Fig. 7) were grooved to allow for the inferior dental vessels and nerves with which they were in close proximity. Considerable hemorrhage hampered the operation. The socket was tightly packed

with gauze for forty-eight hours and subsequently irrigated with normal saline and eusol lotions.

Fig. 8 shows the condition of the jaw five weeks after the operation.

Fig. 9 shows the position of the first molar on the left side (G. D.).

At first I was rather puzzled by this case and wondered why all of the first molars should be delayed in their eruption and why they should have dilacerated roots. Subsequently, I ascertained that the patient had had his tonsils removed when he was about seven and a half years old, under a general anesthetic, and it seems reasonable to suggest that a gag used for opening the mouth might have driven the molars back into the jaw. The dilaceration of the roots appears to have taken place about that period.

**Fig. 7.—Shows the right mandibular first molar of G. D. after removal. There is definite evidence of caries in the crown, and the roots, in addiiton to being dilacerated, are grooved for the inferior dental vessels and nerves.**

**Fig. 8.—Shows the condition of the mandible of G. D. five weeks after the operation.**

Another case of an incompletely erupted and deeply buried molar occurred in a man (M. M.) aged thirty-seven years, Fig. 10.

The patient came to see me at Guy's Hospital complaining of an unpleasant taste, accompanied by swelling and discharge from the right mandibular second molar region. On examination, a sinus was found, and with a probe a portion of a buried tooth was detected. An x-ray film showed the right mandibular second molar, with a very carious crown, lying deeply situated below the alveolar border.

An operation, similar to that referred to in the last case, was performed, but the crown of the tooth was fragile and the roots had to be divided and extracted separately. Once again, considerable hemorrhage occurred, and for several days after the operation, anesthesia of the lip and the front part of the jaw was experienced by the patient.

Recently I saw another man, aged thirty-seven years, whose mandible showed lack of alveolar growth and the molars were incompletely erupted. This had resulted in an open-bite at the back of the mouth.

The next series of cases to which I wish to call your attention is the most remarkable of all. It consists of a number of patients—most of them related to one another—who have been suffering from that strange complaint

Fig. 9.—Shows the position of the first molar on the left side (G. D.).

Fig. 10.—(M. M.) Showing mandibular second molar lying deeply situated in the mandible.

known as hereditary cleidocranial dysostosis, a name which was given to the disease by Comby in 1904. Although the symptoms were described by Morand as early as 1766, it is only within the last fifty years that the hereditary character of this disease has been established. Duncan Fitzwilliam, of St. Mary's Hospital, recorded 60 cases in 1910, and Dr. Percy Stocks gives a full account of the disease in his *Hereditary Disorders of Bone Development* (Cambridge University Press, 1925). It is a condition which affects those bones that are developed wholly or partially in membrane.

In nearly all the cases of this complaint that I have examined, the eruption of some of the teeth has been delayed, and this symptom has been observed in a large number of the 141 cases which have been recorded by various medical practitioners.

The general signs met with in cleidocranial dysostosis are—a large squarish head with straight forehead and flattened vertex. Prominent frontal eminences are observed, and the nasal bridge is flattened and broader than normal. The head as a whole is markedly brachycephalic. (Fig. 13.) The anterior and posterior fontanelles are disproportionately large and frequently remain open until adult life; the middle frontal, frontoparietal, interparietal and parieto-occipital sutures can often be felt. Ossification of the cranial bones is both deficient in quantity and defective in quality. A large portion of the vertex remains in a membranous condition during infancy.

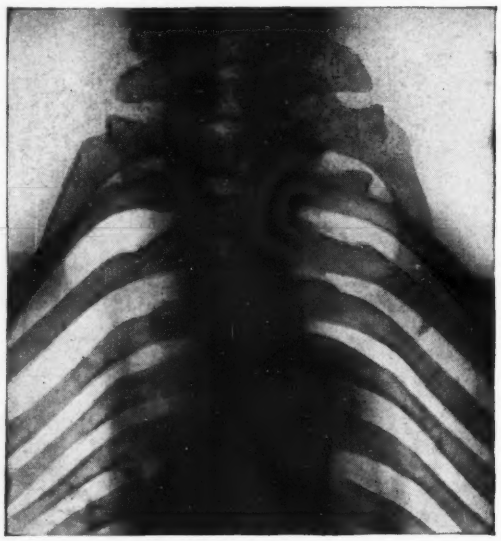


Fig. 11.—Radiogram of the chest of C. E. S., aged forty-six years, showing deficiency of both clavicles.

The two sexes appear to be affected about equally. One or both of the clavicles is deficient, or may be entirely absent, and there is a flattening of the infraclavicular regions. In consequence of this deficiency of the clavicles the patient is able to approximate voluntarily the two shoulder blades toward the middle line in front, and to compensate for the loss of the clavicular attachment of the sternomastoid muscle, the anterior portion is well developed.

You will recall the fact that the clavicle is the first bone in the human body to become calcified; and that calcification occurs next in the mandible, and then in the maxilla. The extremities of the clavicle are derived from cartilage, whilst the shaft is developed in membrane. Spinal curvature is common in these patients. (Fig. 11.)

Cleidocranial dysostosis affects all the bones which are developed in membrane, and that is why the mandible, maxilla, as well as the cranial bones and the clavicles, are involved in this disease. It may be contrasted with achondroplasia which affects bones that originate in cartilage. These

diseases throw some light upon the developmental origin of bones, and it has been suggested that both affections are due to the presence or absence of certain chemical constituents which are necessary for correct ossification and may be looked upon as deficiency diseases.

In cleidocranial dysostosis the face presents various malformations. The mandible usually projects so that the mandibular teeth protrude beyond the maxillary incisors. The lower lip is prominent and this is more marked because the upper lip is small. It is generally agreed that the jaws are narrow and the palate high, and the teeth overcrowded, but some of the cases that

Fig. 12.—(C. E. S.) Radiogram showing the shape of the skull, unerupted incisors in the maxilla, and unerupted incisors and canines in the mandible.

I have seen do not confirm this statement. The maxillae are poorly developed whilst the gums are often hypertrophied. Delay in eruption of the teeth appears to be an almost constant factor, and has been attributed to the restriction of the developmental area of the teeth, through the stunted growth of the jaws, which has been brought about by interference with the calcium metabolism. Briefly, hereditary cleidocranial dysostosis may be described as an arrest of development of individual parts of the embryo at a certain stage, with continued development of the remainder.

Table I gives the family tree of three generations which have suffered from cleidocranial dysostosis. This group of cases came into our hands almost by accident.

CHART SHOWING FAMILY HISTORY
ASSOCIATED WITH DEFICIENCY
Mrs. W.'s Father: greater
WITH A HISTORY OF

B = Brothers. S = Sisters

| B. 1 | B. 2 | B. 3 | B. 4 | B. 5 |
|---|---|---|---|---|
| Greater part of right clavicle absent. History of dental irregularity. | Five years younger than Mrs. W. Part of one clavicle absent. All his erupted teeth were extracted about the same time as Mrs. W.'s. Four years later two maxillary central incisors erupted. | Part of one clavicle absent. Dental irregularity. | Part of one clavicle absent. Dental irregularity. | Both clavicles present and complete, but there was some dental irregularity. |

| BOY | GIRL |
|---|---|
| Clavicles normal. No dental deficiency. | Aged 13 in 1928. Portion of one clavicle missing. At the age of 7, all her deciduous teeth had been extracted, and so far none of the permanent teeth have erupted. |

| MALE 2ND MODELS | MALE | FEMALE 3RD MODELS | FEMALE | FEMALE |
|---|---|---|---|---|
| A. W. Aged 20. On Dec. 28, 1928. ¾ of both clavicles absent. Dental irregularity. See x-rays and models. | B. W. Aged 18. May 15, 1928. Part of right clavicle absent. Said to have no dental irregularity. Patient not inspected. | M. W. Aged 17. Oct. 1, 1928. Part of right clavicle absent. Permanent teeth not yet erupted. See x-rays and models. | V. W. Aged 15. Feb. 13, 1928. One of twins. Part of right clavicle absent. Permanent teeth not yet erupted. This patient is a cripple. The other twin died early. | G. W. Aged 14. June 11, 1928. Clavicles present. No dental deficiency. |

Mrs. W., forty-one years old, was sent to my clinic at Guy's Hospital, complaining of pain of a neuralgic character and inability to wear her dentures. She stated that all her teeth had been extracted four years previously and that she had been wearing dentures from that time until quite recently.

On examination, the alveolar ridges were found to be thick, and the gums hypertrophied. In the maxilla, on the palatal side of the right incisor region, the tip of a tooth could be felt making its way through the mucous membrane (Fig. 13).

It was decided to have an x-ray examination forthwith. This revealed no less than eight unerupted teeth; in the maxilla there were two central incisors lying palatal to their normal positions, and two supernumerary teeth

OF DENTAL IRREGULARITY

OF ONE OR BOTH CLAVICLES

part of right clavicle absent

DENTAL DEFICIENCY

1ST MODELS

| MRS. W. | S. 1 | S. 2 | S. 3 | S. 4 |
|---|---|---|---|---|
| Aged 41. Jan., 1928. Right clavicle ⅔ missing. All erupted teeth were extracted in 1924 and dentures were fitted. In December, 1927, gums became too painful for the dentures to be worn. Gums found to be hypertrophied and alveolar borders thickened. The cutting edge of a supernumerary right maxillary incisor could be seen. X-rays demonstrated both central incisors buried in the maxilla with supernumeraries adjacent. In mandible the x-rays showed two unerupted canines and two premolars. | Most of right clavicle absent. Dental irregularity. | Greater part of both clavicles absent. Dental irregularity. | Clavicles normal. No history of dental irregularity. | Clavicles normal. No history of dental irregularity. |
| | BOY<br>Parts of both clavicles absent. Dental irregularity. | | | |

| MALE | FEMALE<br>4TH MODELS | MALE<br>5TH MODELS | FEMALE | FEMALE |
|---|---|---|---|---|
| Died age of ? years. | | | | |
| L. W.<br>Aged 11.<br>Aug. 25, 1928.<br>Clavicles present. No dental deficiency. | GERTIE W.<br>Aged 9.<br>July 9, 1928.<br>Greater part of both clavicles absent. Dental irregularity.<br>See x-rays and models. | R. W.<br>Aged 7.<br>April 13, 1928.<br>One of twins.<br>Part of both clavicles absent.<br>See x-rays and models. (The other twin died at 5 months.) | I. W.<br>Aged 5.<br>Jan. 2, 1928.<br>Clavicles present. No dental deficiency. | J. W.<br>Aged 4.<br>May 21, 1928.<br>Clavicles present. No dental deficiency. |

immediately behind them. In the mandible were four teeth—two canines and two premolars—the canines were in a vertical position, but low down in the jaw; whilst the two premolars, which were on the left side, lay in a horizontal position. The first premolar had its crown pointing toward the ascending ramus and the second premolar was lying immediately below the first with its crown pointing forward (Fig. 14).

After we had discovered this interesting and unusual condition of her teeth, the patient told us that she had been to another hospital where the doctors informed her that part of one of her "collar bones" was missing. This led us to inquire more deeply into her case and family history, with the result that this chart was obtained. Mrs. W., herself, has less than a third of the right clavicle present, but the left one appears to be normally developed.

When the buried teeth were extracted at an operation a few days later, a thick fibrous capsule was found surrounding the crown of each tooth.

The chart was drawn up from data supplied to us by Mrs. W. There may be some inaccuracies, for we were able to see only nine of those found on the list; but, as far as we were able to check the cases, her information

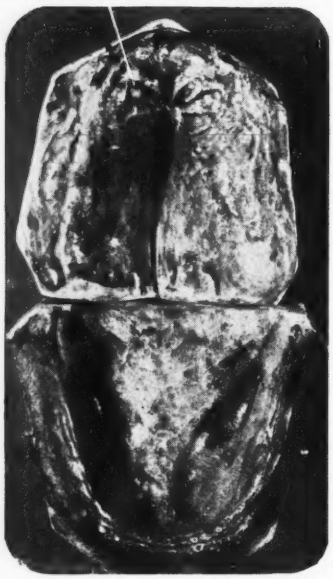



**Fig. 13.—(Mrs. W.)** Models showing the tip of a supernumerary incisor attempting to erupt.

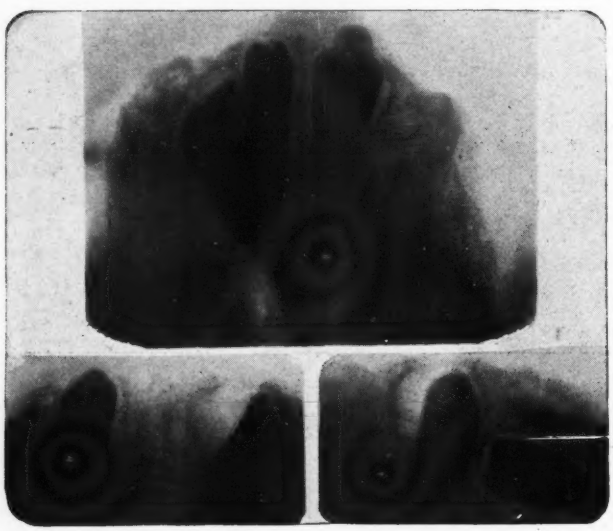



**Fig. 14.—(Mrs. W.)** Shows the radiograms of the jaws with the unerupted teeth.

proved to be correct. Her father, like herself, was reported to have had most of the right clavicle absent, and this was associated with dental deficiency. Mrs. W.'s paternal grandfather, according to her statement, was similarly affected. She has had five brothers and four sisters, of whom one brother and two sisters had normal clavicles. The other seven members of the family have clavicular deficiency, and in each case this defect has been

accompanied by dental irregularities, whereas two out of three, in whom the clavicles were complete, gave no history of dental irregularities. A nephew and a niece, in whom portions of the clavicles were missing, each show signs of dental deficiency.

Mrs. W.'s second brother is five years younger than she is. Part of one clavicle is missing. He had all his erupted teeth extracted in 1923, but in

Fig. 15.—Models of the mouth of A. W., aged twenty years, whose incisors, canines and five of the premolars remain unerupted.

Fig. 16.—(A. W.) Radiogram of the right side of the jaws showing the unerupted and displaced teeth.

1927 two maxillary central incisors appeared through the gum. He has two children—a boy and a girl. The boy is said to have normal clavicles and no dental deficiency; whereas the girl, aged thirteen years, has part of one clavicle missing. All of her deciduous teeth were extracted when she was seven, and so far none of her permanent teeth have erupted.

Mrs. W. has had a family of thirteen children, of whom three died quite young. Of the remaining ten, four have both clavicles present, and in these children there has been no marked delay in tooth eruption. Whereas, in five of the other six, where some portion of one, or both, clavicles is missing, delay in the eruption of the teeth has been observed. I will now deal with each of the members of her family.

The eldest son ("A. W.," aged twenty years) has the middle portions of both clavicles missing. The fontanelles were closed when he was examined at the age of seven years. The only teeth of the permanent series erupted, so far, are the first and second molars, both mandibular second premolars and the right mandibular first premolar. His deciduous incisors and canines are still *in situ* together with five of his deciduous molars, though two of these are badly broken down. (Fig. 15.)

The chart reads therefore:

| | |
|---|---|
| 76EDCBA | ABCDE67 |
| 7654CBA | ABCD567 |

Fig. 17.—(A.W.) Shows unerupted permanent incisors and canines with two supernumerary teeth lying close to the central incisors as in the case of Mrs. W.

The x-ray examination showed (Fig. 16) that the following teeth are present though unerupted,

| | |
|---|---|
| 8 54321 | 12345 8 |
| 8 321 | 1234 8 |

and three supernumerary teeth lie buried with the permanent teeth in the following regions:

| | |
|---|---|
| 8 1 | 1 |

Fig. 17. The second son ("B. W.," aged eighteen years) is said to have part of the right clavicle missing and no dental irregularity; but as I have not had an opportunity of seeing him, I cannot confirm that statement.

The eldest daughter ("M. W.," aged seventeen years) has, like her mother, a portion of her right clavicle missing. The anterior fontanelle is not com-

pletely closed. The palate is narrow and arched. So far, the only members of the permanent series of teeth that have erupted are the four first molars, two mandibular central incisors, the right mandibular first premolar and the left mandibular second molar:

| | |
|---|---|
| 6 4 | \| 6 |
| 6 1 | \| 1 67 |

Fig. 18.—(M. W., aged seventeen years.) Right side of the jaws showing that only one of the premolars has erupted.

Fig. 19. (M. W.) Maxillary incisor region showing two supernumerary incisors as in her mother and brother.

The following unerupted teeth are detected by means of the x-ray films (Fig. 18):

| | |
|---|---|
| 54321 | \| 12345 |
| 5 32 | \| 2345 |

also, two supernumerary maxillary incisors can be seen in the radiogram, and these closely resemble those which were found in her mother (Fig. 19).

The second daughter ("V. W.," aged fifteen years) is one of twins. The other twin died early. This child has part of the right clavicle missing. The forehead is large and bossed and the anterior fontanelle is still open. There

are signs of rickets and bending of ribs. The only teeth of the permanent series that have erupted are these:

| | |
|---|---|
| 76 4 | 4 67 |
| 76 1 | 12 4 67 |

The rest of the teeth have developed, but lie unerupted, and there are six supplemental incisors in relation with the following permanent teeth (Fig. 20):

| | |
|---|---|
| 21 | 12 |
| 2 | 2 |

The fourth daughter ("G. W.," aged nine years) has the greater part of both clavicles absent. The fontanelles are closed, no cranial bossing. All of the deciduous teeth are still in position and the first molars have not yet

Fig. 20.—(V. W., aged fifteen years.) Radiogram of the right side of the jaws.

erupted (Fig. 21). The palate is arched and narrow. In addition to the ordinary members of the permanent series which lie buried in the jaws, the following supernumerary teeth can be seen in the radiograms:

| | |
|---|---|
| 21 | 2 |
| 3 | 3 |

The youngest child ("R. W.,") with deficient clavicles, is aged seven years. Both clavicles are missing except for small fragments at the sternal ends. The deciduous teeth are all in position in the mouth, but the left maxillary central and lateral incisors are geminated.

The radiograms of this case show the first permanent molars situated deep in the jaws, though the normal time for their eruption has passed.

In searching the literature describing cases of hereditary cleidocranial dysostosis, I find that several members of the family that I have just referred to were seen by Dr. George Carpenter in 1899, and others of the family by Dr. Frederick Langmead, who published an account of the general

conditions in the cases that he saw in the *Proceedings of the Royal Society of Medicine* in 1916. Some authorities have stated that this complaint does not extend through more than two generations, but in this series, four generations have been involved.

It was two years ago that I came across the first patient ("C. E. S.") (Figs. 11, 12) suffering from cleidocranial dysostosis. He was a man aged forty-six years, who had deficiency of both clavicles; only one and a half inches were present at each sternal end. In the maxilla the central incisors lay deeply buried and unerupted, and in the mandible the lateral incisors and the canines were similarly situated. In spite of the presence of teeth the jaw was very shallow. There was a symmetrical increase in the width of the skull, and the bones of the vault were thin. Also, there was a deficiency in the frontal bone at the metopic suture. The anterior fontanelle was incompletely closed.

Fig. 21.—(G. W., aged nine years.) Radiogram of the right side of the jaws.

Recently, I have seen two more cases of this complaint and have obtained histories of others. In each instance there has been considerable delay in the eruption of the permanent teeth.

From what I have shown you, it would appear that eruption of all the teeth is delayed in hereditary cleidocranial dysostosis, but it affects chiefly the teeth in the front of the mouth, which have deciduous predecessors. The presence of supplemental teeth in many of Mrs. W.'s family is doubtless hereditary, but I consider these arise from quite independent causes. It would be unwise to draw hasty conclusions as to the causation of eruption of the teeth from the series of cases that I have brought forward here, but I think most of them tend to strengthen the opinion that the growth of bone has a very important bearing upon this question and there is little doubt that in cleidocranial dysostosis there is interference with the calcium metabolism. It is probable that this process of eruption is due to several concomitant forces in which the growth of the jaws, the behavior of the epithelial tissues surrounding the teeth, and possibly even the elongation of the roots of the teeth, all play a part. It seems to me that bone growth is the primary factor in nor-

mal eruption, and that the epithelium surrounding the tooth controls its direction, and, when the tooth is socketed, limits the extent of its eruption to the margin of the enamel around the neck of the tooth.

REFERENCES

1. Fitzwilliam, Duncan, C. L.: Hereditary Cleidocranio Dysostosis, Lancet, p. 1467, November 19, 1910.
2. Tubby, Alfred H.: Deformities and Diseases of Bones and Joints, ed. 2, 1912.
3. Stocks, Percy: Hereditary Disorders of Bone Development, London, 1925, Cambridge University Press.
4. Geig, David M.: A Case of Cleidocranial Dysostosis, Edinburgh M. J., p. 49, 1916.
5. La Chapelle, E. H.: Dysostose Cleidocranienne Héréditaire, Rotterdam, 1918, Van Fleet.
6. Langmead, Frederick: A Family Showing Cleidocranio Dysostosis, Proc. Roy. Soc. Med. **10**: 1, 1916-17.
7. Carpenter, George: A Case of Absence of Clavicles, Lancet **1**: 13, 1899.
8. Schovstein, Gustave: A Case of Congenital Absence of Both Clavicles, Lancet **1**: 10, 1899.
9. Butler, Garrod: Diseases of Children, ed. 2, p. 834, 1929, Thursfield and Paterson.

DISCUSSION

The *President* heartily congratulated the Society on having had the opportunity of listening to Mr. Payne's paper in which the cases brought to their attention were full of interest and gave rise to much food for thought. It was very interesting that the record of these cases should appear in the Transactions of the Society so early in the history of the disease. It was obvious, as Mr. Payne had said, that cleidocranial dysostosis was connected with the calcium metabolism of the body, which, as they knew, was concerned with the eruption of teeth. Had Mr. Payne any explanation for the two cases which he showed of unerupted teeth becoming carious? Why should those teeth have been so affected if the usual conception of the causation of caries was correct? He had intended to comment on the presence of supplemental teeth, but Mr. Payne had given the solution of the problem which he (the speaker) was going to suggest; the presence of the supplemental teeth must have been due to something quite outside the disease.

*Mrs. Lindsay* said she had come across such cases. She asked whether Mr. Payne had ascertained if there was any persistence of the thymus gland, because although it was a very early condition, some early want in the development of the embryo, it might account for the infantile condition, the persistence of the deciduous teeth. Was not this disease something like the condition of progeria which Sir Arthur Keith had brought to their notice in which the teeth were also deficient? Franke suggested that supernumerary teeth were nearly always associated with cleft palate, and their presence was, in fact, one of the stages of cleft palate.

*Mr. Messenger* said he had been extremely interested in the paper, particularly with regard to those cases in which the clavicle was missing. He asked whether there was a history of rickets in that group of cases. He desired to bring to the notice of the members the case of a woman of twenty-eight or twenty-nine years of age whom he had attended and in whom, under x-rays, they had found about 22 unerupted teeth. There were found to be no clavicles. She had given a family history of delayed eruption in two brothers, one of whom was forty-three years of age, with the maxillary deciduous incisors present in position, but he had a number of other teeth. He had then lost sight of that case for a number of years, when, four or five years ago, Mr. Pritchard in reading a communication at the Odontological Section of the Royal Society of Medicine, which had been sent to him by Mr. Pickerill of New Zealand, mentioned a case of neuralgia occurring in the upper right side of the jaws and found to be due to two maxillary premolars which had not erupted. From the description given in the paper he (the speaker) had identified the case as being that which he had seen years before. From this case he gathered that sooner or later teeth made an attempt to erupt and that that attempt was frequently associated with very bad neuralgia. That woman would now be about fifty-four years of age. At the age of eighteen or nineteen she had had teeth extracted which must have been the remains of the deciduous dentition, with probably

the four first permanent molars. At twenty-eight years of age she had lost 2 maxillary central incisors and during all this time she was wearing full maxillary and mandibular dentures. There was a history of rickets.

*Mr. Blaaberg* asked why, in this case of lack of dentition and retarded eruption, Mr. Payne called these teeth supernumerary teeth; they might be laterals; they were placed on the palatal side of the centrals which was the usual malposition of such teeth. In the models which Mr. Payne had shown them, the right supernumerary appeared to be fairly well formed, but the left supernumerary was a little marred at the tip of the tooth; laterals were frequently a little marred in that way, particularly under these conditions.

*Mr. Rt. Lindsay* said they had all listened with great enjoyment to something which was, perhaps, a little off the ordinary line of studies of the Society; he was rather inclined to doubt whether it would be possible to learn any lessons either with regard to orthodontics or the development of teeth from what they had seen and heard. It would be better to regard Mr. Payne's paper as a very enjoyable excursion into one of the borderlines of orthodontic practice. The disease must be accompanied by such an extraordinary aberration, due to some constitutional disturbance, that nothing they found would astonish them; for example, the fact that there was delayed or noneruption of teeth, could only be explained on the constitutional ground of a very severe disturbance. In looking at the x-ray photographs, he had been impressed by the fact that there did not seem to be any material deficiency of the alveoli; the body of the mandible also, was fairly well developed. Therefore the idea that the alveolar bone was purely dependent for its development on the erupting teeth, and was deficient or absent unless the tooth had erupted, seemed to be inconsistent with what was shown with slides. There was also the fact that the crowns of these teeth, so far as the age permitted, were complete in size, although certainly some of the roots appeared to be stunted.

In the earlier part of the paper an interesting point had been raised as to dental caries. It was generally believed that true decay could not take place unless there was some connection with the mouth. He recalled a case in which what was supposed to be decay had occurred in an impacted third molar, but it had been ultimately proved by careful histologic examination that it was not true decay. Mr. Payne's paper bore out this generally accepted theory. He (the speaker) was inclined to disagree with Mr. Payne's suggestion that the elongation of the root had anything to do with the eruption of teeth; Mr. Payne was on safer ground when he ascribed the eruptive force to the growth of the bone.

He wished to add his thanks to those of others for what had been a most enjoyable experience, and none the less enjoyable because it did not seem to teach them anything.

*Mr. W. A. Bulleid* said, arising out of the President's remark as to carious teeth, that, where the mandibular second premolar was absent and the second deciduous molar persisted, one sometimes found the deciduous tooth nipped between the first premolar and the first molar, with its occlusal surface quite level with, or even below the level of the then existing gum, with the teeth before and behind right above it at their normal level. In the models which they had been shown the carious teeth might have erupted at their proper time, but, with the rising of the premolar in front and the molar behind them, had got nipped above the level of the broadest diameter of the crown, by the teeth before and behind, as in the case of the deciduous molars, these permanent teeth might have been held down and in fact forced down by the rising of the two teeth before and behind, and the posterior one drifting forward a bit. That seemed to him to be the explanation of the position of the teeth and of the fact that they were carious.

*Mr. Pritchard* thought one of the most significant facts arising from the paper was that the delayed eruption of teeth concerned only those that had no deciduous predecessors; in the models they had seen, the milk teeth and usually the first and second permanent molars were in position, whereas the teeth which would normally replace the milk dentition had suffered this delay. Caries in unerupted teeth usually occurred in the milk dentition. The speaker showed the meeting a photograph of a very carious second deciduous molar which had undoubtedly at some time been in line erupted, but had been forced down again by subsequent movement of the other teeth.

*Mr. Strickland* described the case of a male patient of his of eighteen years of age, whose teeth were unerupted and whose incisors were extraordinarily small, of the Hutchinson type. Two sisters of this patient had normal dentition except that the teeth of one sister were very small. These three persons were the issue of the marriage of cousins, there being, he believed, a previous marriage of cousins in their ancestral history.

*Mr. Lewin Payne,* in reply to the questions of the President and others, said that at the outset he had himself been puzzled as to the explanation of the carious condition of unerupted teeth in two of the cases he had shown, but he thought he had discovered the reason. As had been stated in the discussion, unexposed teeth did not become carious. In the first of the two cases—that of the boy of thirteen years—the right first molar had a dilacerated root, in addition to the caries. This dilaceration occurred also on the left side. The boy had had two operations performed on his throat under general anesthetics at about the period when this dilaceration occurred. At the time when dilaceration occurred, probably the tooth was in the process of eruption and its erupted crown exposed on the surface. Was it not possible that a gag was put into the mouth, and by pressure upon the molars had driven them back into their sockets? Such a theory might explain the presence of caries as well as the dilaceration of the roots. In the second case there was a definite sinus connecting the tooth with the surface of the gum.

Mrs. Lindsay had referred to the persistence of the thymus gland; he had not seen that question discussed in any of the papers which had been written upon the subject of cleidocranial dysostosis. He thought, however, that this disease was in the nature of a deficiency disease, and might very well be described as allied to that condition known as progeria to which Sir Arthur Keith had referred at a meeting of the Society some two or three years ago. The number of persons suffering from this disease who also had cleft palates, was certainly large. The palate of the mother, to whom he had referred in his paper, was deep, and a very definite groove in the maxilla was shown in the first model.

Mr. Messenger had suggested that these cases were due to rickets. Mr. Lewin Payne said there was no history of rickets in his group of cases. Rickets might be associated with this disease and in some of the recorded cases there is evidence of such a combination, but there were certain definite symptoms which distinguished hereditary cleidocranial dysostosis from rickets. The character of the skull, the late closing of the fontanelles and other deficiencies might bring the two conditions into close alignment, but the general character of the chest was certainly not that of a rickety patient. Rickets and cleidocranial dysostosis might occur simultaneously in the same patient, and that seemed to be so in the case to which Mr. Messenger had referred.

In reply to Mr. Blaaberg, he considered the teeth of the mother to be supernumerary because they were not of the normal form of lateral incisors. Also, supernumerary teeth of a similar character were to be found in other members of that family whilst the lateral incisors were still present. As to the criticism that the paper was unsuitable to this Society, it seemed to him that the question of eruption of teeth was one of the most important for the British Society of Orthodontics to discuss, but he was sorry that Mr. Lindsay had been unable to learn anything of orthodontic interest from the cases which had been shown. He agreed with Mr. Lindsay that the growth of bone, working in combination with the action of the epithelial cells, was the chief factor in the eruption of teeth, but he still felt that the elongation of the roots did play a secondary part in many cases.

# SOME ELEMENTARY PRINCIPLES OF BIOLOGY APPLIED TO ORTHODONTIC PRACTICE*

By Norman Gray, H.D.D., R.C.S.Edin., L.D.S.(Liv.), Liverpool, England

IN PRESENTING my paper, I do not propose to draw your attention to anything original or new, but rather to emphasize some fundamental principles laid down in the very comprehensive report of the Education Committee to the British Society for the Study of Orthodontics in 1925. The Report defines dental orthopedics as "the study of the growth and development of the jaws and face particularly, and the body generally, as influencing the positions of the teeth, the study of the action and reaction of internal and external influences on this development, and finally the prevention and correction of perverted and arrested development." This strongly suggests the biologic point of view. The report states that "the aims of orthodontic practice are to obviate the evils of irregularities of the teeth which are frequently so gross as to constitute an obvious defect of feature, often accompanied by perverted respiratory function, impaired biting power, and an increased liability to pyorrhea and dental caries; they should be both preventive and curative."

The complex problems in this field are essentially biologic in their nature, although at present our method of treatment is mechanical. We apply force to the teeth by means of levers and springs, and therefore a great proportion of dentists think that orthodontia is nothing more or less than a mechanical problem.

A surgical operation is a mechanical process, scalpels, forceps, needles—mechanical from start to finish, but no one would consider a knowledge of the technic a sufficient qualification for surgery. Knowledge of this kind is found in the study of vital phenomena—biology and its allied subjects.

Dr. Leroy Johnson,[1] upon whose teaching and writing I base this paper, states that the foundation of the biologic point of view in orthodontia is "That form of structure is the result of an interaction of function and structure, and that in the ultimate, function is the determining factor in form development." This is the point I wish to stress. I shall, therefore, have to repeat it frequently. The only way to repeat without monotony is to do it openly and frankly.

In orthodontic problems we are dealing with the results of perverted developmental processes. Development is the result of the mutual action of function, environment and heredity. It is this that imposes all the qualifications in diagnosis and prognosis. The first two we can influence, the last we cannot. The form of structure is never entirely determined by one force

*Transactions of British Society for the Study of Orthodontics.

alone. More and more biologists produce evidence to support the belief that the factors of development are inherent in the cell as much as external environment.

E. G. Conklin, in his book, *Heredity and Environment*,[2] states that "The entire organism develops out of the germ and the organization of the germ determines all the possibilities of development, though the actual realization of any possibility is dependent upon environment stimuli."

The intrinsic vital forces within the germ cells fix the possibilities of development and set bounds which cannot be passed. This is a fundamental principle. We inherit the possibility to grow to a certain size, but whether the inherent possibilities we possess are realized depends largely upon the environment in which we live.

The anthropologists tell us the human face, nose and jaws are retrogressing. That in the gradual evolution of the brain of modern man, material that once went to form the facial bones has been utilized for the cranium. That retrogressive changes have taken place in the human face we cannot question; we have clinical evidence every day in missing third molars, premolars and incisors, and possibly impactions, etc., but the causation of these is still a matter of controversy.

It seems that life is a balance of forces. The evolution of certain structures is made possible by the atrophy of others.

When, without due consideration we adjust appliances to badly crowded teeth, to expand the mouth, as we say, we may be trying to correct in one local region a condition that is inherited, and so beyond all mechanical influence. Many cases respond to present methods of treatment, some do not, and I venture to suggest that a very potent cause of faulty prognosis is our circumscribed point of view.

Biology is the general science of organisms, plants and animals alike. It deals with that peculiar activity we call life. The *Encyclopædia Britannica* describes it as a general science, because it includes the special sciences of botany, zoology, bacteriology, anatomy and physiology.

It deals with:

(1) Analysis of structures both macroscopic and microscopic.

(2) Analysis of functional activity. How does it work to keep things going (physiology)?

(3) Embryology which inquires into development and investigates the factors that are operative in growth.

(4) Etiology asks, How have these organisms come to be as they are, both as regards themselves, and as regards their interrelations?

A knowledge of microscopic and macroscopic anatomy of teeth, periodontal membrane, alveolar bone and surrounding muscles, is of little value to the practicing orthodontist unless he appreciates relationship of these parts to one another, for the various tissues do not act alone, but are integral parts of that organization which is life, and which when broken down leads to disease, disharmony, death.

The general teaching of anatomy in hospital leads to curious ideas about bone. One cannot help getting the idea that bone is a solid structure, hard

and unyielding. Such is the nature of dead bone, but not the living. Although bone feels hard to the touch, and sometimes will cause us an infinite amount of trouble in a difficult extraction, it is the most highly specialized of the connective tissues. From the standpoint of physiology, bone is secondary to muscle, therefore the latter dominates its development. This cannot be too strongly emphasized. The form of bone is the sum total of the many forces of heredity and environment, and partly of the mechanical and chemical influences to which it is subjected during growth. Bone is a cellular tissue readily penetrated by the developing nerves and blood vessels.

The effect of the lack of use on the growth of bones deserves investigation.[3] Allison and Brooks in "A Clinical Study in the Changes in Bone which Result from Non-use," state that growth in length and thickness of bones takes place in complete absence of any use whatever. They also state, however, that lack of use of an extremity during a period of growth will ultimately result in a shortened extremity.

Mechanical fixation of the long bones will frequently cause bone atrophy. That is an accepted fact which we must consider carefully in the construction of our orthodontic appliances. In the degree that we limit physiologic movement of the teeth in normal function, we create conditions favorable to atrophic changes in the alveolar bone of the jaw. Those of you who are acquainted with the pin and tube appliance or any rigidly fixed appliance in which multiple teeth are banded together, will have noticed how frequently the teeth are loosened; obviously a change has taken place in the alveolar bone. Leroy Johnson, in an article entitled "Growth and Development" in the *Cosmos,* says it is difficult to think of a more effective way to prevent growth processes. Similarly, the locking of a maxillary incisor inside the bite will quite often cause looseness of the mandibular opponent. Again an atrophic change through lack of function has taken place.

As with bone, so with muscles, the teaching of anatomy in the dissecting room leaves a faulty impression. The student imagines that each bundle of muscle fibers is an entity. He learns of each its distinctive name, its origin and insertion and its action. He is taught that the action of the masseter is to close the jaw, the interior pterygoids pull it one way and the exterior pterygoids pull it another, and so he believes that each movement of the mandible is merely a question of the contraction of certain well-developed muscles. Sir Arthur Keith in *Menders of the Maimed*[4] says, "There is no such thing as a single muscle in the living organism with which physicians and surgeons have to deal; every muscle is woven into a functional complex." Muscles move and act in groups. The study of embryology teaches one better to understand the functional interdependence of these muscle groups. Reading different authorities on this subject has made me careful about prescribing exercises. One cannot prescribe exercises unless one is sure the group is subnormal. If subnormal, doubtless well-devised exercises can be very beneficial, but one can easily start habit movements capable of greater harm than the presumed muscle weakness could do. I say "presumed" because we still lack sufficient data for comparison of facial muscle norms, although I should be the last one to discount the work of Dr. Sheldon

Friel. A patient of mine (a girl of twenty years) is very attractive and dainty in every respect except for her lips, which are dreadfully coarsened. I believe this condition can be attributed solely to an unchecked habit of twisting the lips with her fingers. I have often noticed thickened fibrous tissue in the lips caused by the irritation of a typical mouth breather, but the tone of the girl's lips is quite different.

It is comparatively easy to control the large skeletal muscles by the Sandow systems of prescribed exercises, etc., but the same simple control of the face must not be expected. Consider too the peculiar susceptibility of the facial muscles to squints, twitchings and mannerisms. Formerly I encouraged muscle exercises of all sorts, but the only suggestion I dare offer now is a more vigorous mastication of fibrous foods and extra deep breathing exercises at school.

With regard to the nervous and vascular structures, I am not able to discover any suitable authority to quote in this paper, but the blood vessels are not toneless tubes injected with red lead in real life. Their function is vital in bringing nutriment to the part, and so one can conceive that lack of function or even pressure from ill-fitting or untended vulcanite expansion plates might interfere with this supply of blood nourishment. The development of vessels must be largely adapted by the direct requirements of the part it supplies. Nerves are intimately associated with the muscles in development and are as functional and interrelated as bone and muscle.

This brief summary of the dental structures is not to labor the obvious, but to emphasize the vastly different characteristics of the component parts of the jaws and teeth and soft parts, and the different factors involved in development. The teeth are supported on all sides by tissues whose development depends on normal function. The crowns of the teeth are complete in adult form long before they function in mastication, while bone, muscular, vascular and nervous tissue depend for their complete development upon the stimuli derived from mastication. This wide difference in developmental characteristics makes abnormalities more obvious in the mouth than in other parts where the tissues are more nearly alike.

To repeat, the growth of the various tissues is influenced by different sets of factors working in harmony. When one or more of these agencies fails to operate, we see the results in malocclusion of the teeth.

The point for us to determine is whether the disharmony can be corrected by building up the functional structures, i.e., bone, muscles, to the requirements of the teeth, or whether teeth must be sacrificed for the good of the whole apparatus.

In bringing this point of view to practical orthodontics the greatest service we can render is still by mechanical appliances; doubtless it always will be so, but I think we shall find that these principles will sooner or later cause us to alter the type of many appliances in general use. The biologic point of view recognizes the degenerate tendencies of the human jaw, and so realizes in some cases that extraction is indicated—a point which the

Angle School is unwilling to concede. Our interest will also be turned to the connection between defective nutrition and retarded growth.

As biology is applied to orthodontia, thought must be turned logically more and more to prevention as better than cure. Prevention does not merely mean control of malocclusion of the teeth. Maldevelopment of the jaws has a higher percentage than maldevelopment in any other part of the body. Therefore disease is more prevalent here than anywhere else.

The effect of mouth-breathing, rhinitis, adenoids, diseased tonsils, caries and pyorrhea upon health cannot be estimated, and I think it is time the emphasis was turned from pulpless teeth to these still more numerous factors.

And so I wish to switch your attention over to a totally different subject, Preventive Dentistry, propaganda, if you like, for expectant mothers in particular and those interested in child welfare in general.

The November, 1928, editorial of the *Cosmos* states:

"The evolutional development of dentistry from the point of view of its intimate relationship to the other biological sciences, has opened a most hopeful avenue of approach to the solution of some of the many problems which have long been a source of anxious concern to the thoughtful members of the profession.

"One of the direct results of this awakening by dentistry was a fuller realization of the inhibitory influence of mouth hygiene upon dental disease. It soon became evident, however, that concentration upon the ideal of mouth hygiene was only a means of postponing the evil day, and that the prevention of its ultimate analysis involved the structural character of the tooth itself.

"As a result of this line of reasoning the attention of the profession began to be directed to dietetics in its relation to the formation of tooth structure.

"And here let us say that it is doubtful if the average dentist quite fully realizes or appreciates the widespread influence that the mouth hygiene propaganda which has been so assiduously prosecuted by the dental profession for the past few decades has had upon the question of public health. We are convinced that this propaganda has in a large measure been responsible for the inauguration of much of the research that has been conducted in recent years in the field of dietetics. In fact, our own dental researchers have taken a most conspicuous part in this work and have contributed notably to the knowledge of dietetics in its relation to preventive medicine."

I daresay you have all heard the saying of the prophet of old, "Wherefore do ye spend money for that which is not bread and your labor for that which satisfieth not. Hearken diligently unto me and eat ye that which is good."

The majority of the diseases of civilization are not caused by the microbic, chemical and glandular factors which are usually held responsible. These are only the secondary causes, the primary cause is to be found in our mistaken methods of living. The causation of most diseases may be classified under one of the following six headings:

Diseases arising from faulty food and feeding.
" " " lack of air and sunlight.
" " " lack of exercise.
" " " lack of rest.
" " " faulty habits.
" " " combination of these causes.

Civilized men differ from animals and primitive men by living on refined ultrasoft and highly concentrated foods. European "civilized" races, which are scientifically fed, suffer to an extraordinary extent from nutritional diseases and their consequences. Animals and savages, who are unscientifically fed, who know nothing about proteins, carbohydrates, calories, vitamins, enzymes and so forth, do not suffer. If we wish to feed correctly, it would appear that we can learn at least as much from the animals and savages as from the scientists. Plain human knowledge seems to be disappearing. In the army anyone could tell by his eyes and nose whether a man was drunk. Now the police surgeon is bidden to make scientific tests by analyzing the blood, urine and cerebrospinal fluid, and this idea of scientific tests seems to have found its way into patent pills and food circulars.

Wild animals and savages as a general rule, prefer freshly killed food to dead, and green food to preserved food. Cats and dogs will eat birds and mice, etc., which they have killed for themselves, and birds will eat worms which they have caught alive, but their unerring instinct causes them to consider birds, mice and worms which they find dead as inferior and not worth eating, unless forced by starvation. Similarly, cows and horses will rather eat fresh and live green fodder than most tempting man-made foods.

Bones and teeth cannot be made without calcium. Vegetable foods are richer in calcium than are flesh foods. A very interesting report emanating from The Mayo Clinic commented on in the editorial of the *Journal of the American Medical Association,* states that, "The feature that seems to be of definite etiologic significance in prevention of dental decay is a diet composed largely of vegetables." Meat (apart from kidney and liver) contains neither mineral substances nor vitamins, yet it is a main item on the menu card. We carefully discard most of the calcium and other mineral elements in wheat, rice and barley. We overboil and recook vegetables, bleed our potatoes before cooking and throw the water containing vitamins and mineral substances down the sink. We peel apples, pears, cucumbers, etc., being determined to eliminate every particle of roughage from the diet. Just under the skin of most natural foods lie the valuable organic mineral elements, and the presence of these in a natural form is essential to the normal nutrition of the body.

Scientific diet has been weighed in the balance and found wanting. Malnutrition! is the handwriting on the wall of the modern Babylon in which we live. Malnutrition leaves an indelible scar during development that cannot be entirely eradicated. "Mineral starvation" describes in a word the dental conditions of today.

That is usually what happens to the mother's food. The treatment meted out to the baby is a thousand times worse. Most frequently it is unnaturally fed from a bottle of "humanized" milk, and then instead of working hard for its food by chewing, sucking and pulling at the breast, the little one merely opens its mouth and swallows the milk.

Scientists tell us that the human being is born with an extremely large number of tendencies to certain sorts of action, and the first reaction in any situation is strongly influenced by these tendencies. Instincts, if not allowed to develop, pass away.

Sucking is an instinct which is very strong in all animals. The eruption of the deciduous teeth marks the time for the baby to begin taking food that needs chewing, obviously the time to develop the habit. Unless this is done at this time, the chance of ever developing it sufficiently to establish and maintain normal dental arches is very doubtful.

The older a child gets the more unnatural becomes the food. Milk is replaced by slimy soft "scientific" food of various kinds. Soft white bread minus crust, soaked biscuits, milk puddings, minced vegetables, minced fish and minced meat cooked to the consistency of cream cheese. The baby, the growing child, the older child are all fed on pappy food.

The jaws of the pap-feeders cannot be expected to develop properly. In this country, the narrow receding jaw is universal. In France they call it "la bouche anglaise." It may be fashionable, but it is a physical disaster of the first magnitude. I have been told by medical men that it is out of place for the dental surgeon to prescribe diets; be that as it may, however, we may make very valuable suggestions. If we really believe faulty diet to be associated with dental deformity and disease, surely it well becomes us in the spirit of progress to preach preventive dentistry in season and out of season. Not only are the jaws and teeth badly developed and weak, but all the organs and structure around, narrowed palate, contracted nasal passages and throat, and mouth-breathing with all its attendant evils, tonsils, adenoids and increased susceptibility to air-borne diseases such as pneumonia and tuberculosis.

With regard to fresh air, we all know it is highly beneficial, and I do not need to dilate on this point. A few minutes in a stuffy room and one feels the effects. Everyone is aware that foul and stagnant air leads to ill health and disease. The benefit of sunlight, however, is not sufficiently well known, and the lack of sunlight in the British Isles may yet prove to be a main factor in causation of orthodontic problems.

Modern teaching has shown that sunlight is the best disinfectant we have; it should be freely admitted to every human dwelling place; sterilize the child's living and classrooms with sunshine. It is a crime against the rising generation to have the nursery anywhere else but the sunny side of the house; these points should be constantly preached to parents and those responsible for the young life of our country.

Unfortunately, we civilized beings have perforce to miss a great deal, but children do not need to be so wrapped in thick clothes as to prevent the total access of the sun and air to the body. The wife of the headmaster of a big boys' school brought her three-year-old girl to me in a bathing costume only

last summer. That was a glorious sunny day in Eastbourne. It may make you smile here in London, but I shall expect that child to develop normally, because that parent was putting these other principles into practice as well. Why not talk along these lines to the mothers of our child patients? We know that our English climate does not give many opportunities, but let us learn to make full use of those she does give. Let us impress on parents the value of the open-air life, encourage sleeping out-of-doors in summer weather and the reduction of unnecessary clothing.

Muscular exercise is vitally important because it activates the chemical and biologic changes of the body. Long ago, Hippocrates wrote: "All parts of the body were made for active use. If moderately used and exercised at the labor to which they are habituated, they become healthy, increase in bulk, and bear their age well." With the popularity of cheap cars, children as well as adults may lose one of nature's most needful adjuncts.

Right food, air, sunshine and exercise are nature's remedies and health factors. Sleep is kind nature's sweet restorer; the physiologist tells us it is actually more necessary than food. Lack of sleep damages the brain and nervous system.

I have said a good deal about malnutrition because I think it is a factor of fundamental importance in the prevention of the dental deformities we are called to treat; but I do not wish it to overshadow the earlier part of my paper, and so I return to my first subject.

I hate to appear as an orthodontic Bolshevist. Destructive criticism is not pleasant to indulge, but we must free ourselves from mere traditions, remembering that by doubting we may come to seeking, and by seeking find truth.

We may observe the changes in the jaws incident to growth and treat aberrations therefrom by appliances, but the growth impulses *cannot* be created (or stopped) at the will of the dentist. We may attempt to deny it, yet the fact remains that an ordering, controlling principle of some sort exists in the phenomenon of growth. In the degree that we sense this principle, we shall stand in awe of it, realizing that our greatest service will come through an intelligent interpretation of its tendencies.

Although a wise man said, "Spare the rod and spoil the child," the tendency nowadays is to keep the rod in the background for slow and deliberate application on state occasions, thereby redoubling its importance and value as a corrective. It is the same with orthodontic appliances.

I should like to close this paper by mentioning one or two personal experiences.

Tooth movement must be established through pressure, either by the normal forces of development or by artificial stimulation. To apply pressure artificially, one must have a stable well-anchored appliance, but how is one to apply pressure from well-anchored teeth without the possibility of inhibiting or perverting the delicate phenomenon I have been describing? One cannot. Therefore, one must learn to be afraid of appliances and use them as sparingly as possible. In my own practice, whenever possible, I make very ac-

curate plaster impression models, and then, if I have in my mind the slightest hope of natural development taking place, I hold over the treatment for two or three months and then compare with the models. When the appliance is used, it should be slow and deliberate in action, and one's aim should be to interfere with normal function as little as possible.

I believe the forces we apply are usually far too great. I have tried cutting down the tension and gauge of springs, and I have been astonished after holiday periods to see the amount of movement that can take place with weak pressure. I find pressures do not need to be adjusted oftener than once in three weeks. When intercusp relation of the teeth has been maintained for some time, or what the Americans call a position of mechanical advantage, I introduce rest periods without appliances at all. I believe this gives nature a chance to take a turn at the wheel and to show what she can do by normal methods.

Dr. Mershon says, "Although reapplication is often necessary, the final result is more stable, and frequently retention is unnecessary." I heartily endorse this statement from my own experience.

The teeth are not planted in the alveolar bone like nails in a board; bone is vital plastic tissue. Its function, form and structure depend upon the stress it has to bear. These attributes only remain constant when there is equilibrium of the forces acting upon it, tooth contacts, lip and tongue pressures. When this equilibrium is upset by massive appliances, destroying function, the bone will continue to change until equilibrium has been reestablished. But as I said before, because the relations of the teeth can be changed it does not necessarily mean bone growth has taken place. Surely this argues for appliances which interfere with function as little as possible, and for the rest periods of Mershon.

My remarks are based largely on the fixed appliance. I believe the time has come when one should fearlessly stick up for the American lingual and labial arch technic, with the iridioplatinum group of metals.

When I went out to study orthodontia in the States, I had seen a good deal of the various fixed appliances and vulcanite plates taught in the English schools. Eastbourne, as you know, has many schools, so one cannot help seeing a great variety of appliances.

Forgive me for making comparisons, but in very many cases the children treated on the other side of the Atlantic had neater and simpler appliances than those treated in the British Isles and Europe generally.

It was the neat and practical design of the fixed appliance in the mouths of children treated in U. S. A. that gave me a real incentive to this fascinating branch of dental practice.

Later, at the University of Pennsylvania, in the Graduate School of Orthodontics, my enthusiasm faltered when I found how thoroughly inefficient I was myself. Honestly, I believe the great bar to orthodontic treatment on right lines is the difficult technic. One *must* put in hours and hours of practice soldering, but once you get the technic you will never go back. In America, orthodontia is largely taught to graduates, the student learns only

classification and tooth relations. I know of no graduate teaching in this country, and it is a great lack. The dental surgeon who is not prepared to develop technical skill ought to be prepared to pass orthodontic cases on to those who have made it a special study.

If the orthodontist tries to visualize the complicated problems nature is working out in the developing child, can he with a clear conscience continue to wedge the teeth apart with gigantic vulcanite bite planes? Would he like his own child's mouth forcibly expanded by screws and massive appliances? I have seen children with half the teeth in the head loose after such rapid treatment. Although some esthetic result of the anterior teeth may be gained a while, years of retention will not make it permanent if the boundaries set by nature have been overstepped.

Albin Oppenheim, in his paper on "Tissue Changes Incident to Tooth Movement," states that movement must never be rapid or powerful, and that the gradual and continuous effect of a spring is preferable to the intermittent action of a screw.

Mr. and Mrs. Lindsay, commenting on this in their paper of 1925 on "Research into Bone Growth,"[5] say: "Only under gentle movement does bone reconstruction take place, and the slower the movement, the shorter is the time necessary for subsequent retention, because during these slow movements the tooth is not loosened. The firmness of the tooth during movement being the criterion for the correctly measured force."

With regard to lost muscle pressure, although I do not feel experienced enough myself to prescribe muscle exercises, I often wish the sugar cane habit was developed in this country. Out East I have watched the natives chewing the bamboo-like substance to extract the sweetness, and I wish that the tremendous force required to chew the bamboo sugar cane could be used by English children. Mr. Chapman once suggested my advising the use of the Sorbo bones given to puppies. A few minutes' chewing of this rubber substance makes the jaw muscles ache dreadfully, but I am sure it is a valuable muscle exercise, and the rubber can be readily sterilized by boiling.

There must be thousands of children in this country standing in urgent need of orthodontic treatment, and yet nothing is being done for them. Often the reason is an economic one; often it is because the dentist is too busy or not interested. My paper is not concerned with such cases tonight. I want to speak to men who are enthusiastic about orthodontia but find themselves up against it more often than they care to admit. I hope this paper will not dishearten such by not emphasizing our complex problems. I hope it will interest you in another point of view, so that as biology is approved we may apply it in practice and help nature to help herself.

REFERENCES

1. Johnson, Leroy: Field of Orthodontics, Cosmos, 1923.
2. Conklin, E. G.: Heredity and Environment, Princetown, 1917, p. 213, Princetown University Press.
3. Allison and Brooks: Bone Atrophy, Arch. Surg. 5: 499, 1922.
4. Keith, Sir Arthur: Menders of the Maimed, London, 1919, p. 96, Oxford University Press.
5. Lindsay, Lilian, and Lindsay, Robert: Some Consideration of Recent Research Into the Growth and Formation of Bone, Tr. B. S. S. O., 1925.

DISCUSSION

The *President* said that this paper covered a very large field, and it was most unfortunate that the time for its discussion was so limited. Only a very short period remained. His own contribution would be simply to point out the biologic note which might be found in the well-known quotation from Shakespeare, beginning, "There is a tide in the affairs of men which taken at the flood leads on to fortune," and ends with the lines, "And we must take the current when it serves or lose our venture" (Julius Caesar, Act. iv, 3).

*Mr. Harold Chapman.*—I am very glad Mr. Gray has brought forward this subject. Much emphasis has been laid of late on the biologic point of view, and I, personally, felt very much at sea in its presence—I felt there must be something about it I had not grasped; from what Mr. Gray has told us it seems that, in brief, it is "the orthodontist is dealing with living tissues, not with nails in a board." Perhaps orthodontics has been regarded as a problem in mechanics because the treatment has been largely mechanical, and because in a later period it was assumed that normal occlusion could in all circumstances be produced by mechanical means and be made permanent. Are we to assume from Mr. Gray's paper that the latter is a fallacy? Personally I believe it is, and the essayist seems to support that view, and the reason may be that we are dealing with the living tissues which comprise the masticating face; in orthodontic cases these are anatomically abnormal; in my opinion it is doubtful if any treatment can make these cases normal, but in many there is a sufficiently near approach to it; other cases do not react to our mechanical procedures as we would wish because too much has been attempted; it is doubtful if errors of growth of the masticating face can ever be corrected absolutely. Dentistry itself is a biologic problem; it is treated very largely by mechanical means, but I hope the students of today are taught to realize that their profession presents a biologic problem. The writer then takes us on to the etiology which he appears to regard as near the origin of our troubles. Everyone must agree with him, and he cites particularly heredity and environment. But we are not taken further along those lines. I see no prospect of an immediate solution of the etiologic problem, so we must proceed without it. We know, e.g., that there are children of three years of age with post-normal occlusion and its correlated abnormalities. Personally, I believe many are born so. We know also that the condition can be improved and in some cases that it can be converted to normal occlusion, whatever the cause was. Our particular biologic problem, it seems to me, is to know in what circumstances the one or the other can be accomplished, or when it is better that no treatment be attempted. This appears to offer prospects of solution. The tissue most involved is bone, and the particular bones are those of the masticating face, which is maldeveloped; the muscles, too, may be maldeveloped and may also be concerned in the bone maldevelopment, but I think Mr. Gray has laid undue stress on their influence; likewise function, if many of these abnormalities are of prenatal origin, as I believe, then function on the part of the individual can have nothing to do with causation in those cases. The problem is to what extent, in given circumstances, we can prevent or correct, entirely or in part, that maldevelopment, whether it be by appliances, extraction, or any other of the methods the essayist has referred to. We deal with the maldevelopment by changing the shape of the bones, perhaps by enlarging them, and by changing their relation to one another, or we may remove a tooth, or teeth, and change the position of others. That the bones contain teeth has made these things easy superficially, but many of us know that if we probe deeper the changes have not been permanent as often as we would wish, but there are times when they are permanent. I feel that our biologic problem is not so much a lack of realization that we are dealing with a living tissue (bone), but to know the circumstances in which we can produce a permanent change in that bone or in the position of the teeth with the least damage to both of these. We must know how to handle not only appliances but tissues also and the two in combination. I remarked to Mr. Friel once that it was unfortunate that we had at hand the means (teeth) to change the superficial aspect of the maxillary bones so easily and that it would have been better for orthodontics if we had had to produce our results on edentulous bones; he replied that only a while before an orthopedic surgeon bemoaned the fact that there were no teeth in the bones with which he had to deal, as they would make such excellent handles whereby he could manipulate the bones. In conclusion,

I would like Mr. Gray to tell us if it is his opinion that appliances stimulate bones to grow, and I also want to thank him most sincerely for having brought this subject before the Society and stimulated us to regard our problems as problems of life and not of mechanics.

*Mr. Norman Gray,* in reply to the brief discussion, apologized for the length of his paper. He suggested that instead of speaking about normal occlusion one should speak more about typical occlusion. No hard and fast rule could be laid down with regard to occlusion because there was no fixed point to deal with. With regard to appliances for making the bone grow, this description might be applied to any appliance which acted as a means of exercise if it had something to do with function—for instance, in mastication. He thanked the meeting for the considerate attention given to his paper.

# A NEW CLINICAL SIGN OF RICKETS AND MISSING TOOTH GERMS*

By Dr. Corrado d'Alise, Naples, Italy

AS IN the practice of other specialities of medicine and surgery, so in that of orthodontia, we note some very interesting facts in consequence of their gravity; that is, the more our scientific knowledge increases and our technical ability is perfected, and the more we increase the means of cure, the more frequent and graver become the malocclusions, their cure becomes more difficult and more uncertain, and the results become less permanent.

This is a fact that very few orthodontists have noted and considered, yet it represents one of the most important and darkest problems of our daily scientific researches. This partly happens because we too easily allow ourselves to be impressed and guided by the small successes obtained in our professional labors and studies, rather than by the failures that are even more significant and instructive than the successes, and also because, in etiologic investigation of malocclusions, we take little or no account of the remote causes, and make much of the recent, attributing to the latter that which instead has long been prepared by the former, often for generations.

And as this that we note in orthodontia happens also in the other specialities of medicine and surgery, we think that a closer collaboration among the different specialities might facilitate the solution of many etiologic problems that today are still unsolved, and which interest as much the orthodontist as the orthopedist and every other physician. In practice, instead, while assisting at a true and salutary re-awakening of the study of the relations between dental diseases and those of other organs, and between these and those of the teeth, many orthodontists consider malocclusion as a purely local disease, without troubling themselves about all the general contributory causes, and, on the other hand, the orthopedists treat deformities of the trunk and of the limbs without taking any interest in those of the face and of the dental arches closely bound up with them, and often having the same etiologic causes, like rickets and osteomalacia, and which are not less interesting to other physicians.

The same thing occurs in another field, that of digestion, in which specialists of gastrointestinal diseases ignore or neglect the physiopathology of the dental system, and consequently of the oral digestion, as many dentists are unaware that certain diseases of the teeth and gums depend directly on gastrointestinal disturbances.

And this present division in the study of the human subject both in health and disease is not followed by a logical synthesis in the cure and prevention of human diseases, is perhaps the principal reason of the failure of so many not altogether useless studies of the laboratory.

*Read before the Congress of the European Orthodontological Society.

But if the fault of this tendency belongs a little to all who exercise the healing art, the chief fault falls on the physicians, who, in spite of its being recognized and demonstrated for centuries that the human body is only divisible in its different parts for reasons of study, but that in the estimate of any one of its impaired functions it must be considered in its entire harmony, yet today they are obstinate in thinking that the teeth do not deserve their attention and study, and therefore physicians come out of the university and begin to cure the different infirmities of the human body without ever having studied the physiopathology of the dental system, with serious damage to science and suffering humanity.

And so we see that orthopedia, which is the science that studies the cure and prevention of deformities, especially in children, notwithstanding its old scientific maturity, only limits its studies to the cure and prevention of deformities of the trunk and limbs, leaving apart the head, almost as if this did not belong to the human body and it was not governed by the same biologic laws that govern the rest of the body.

Orthodontia, instead, arisen modestly from quackery, to which physicians had abandoned it, in a few years has run through all the phases of its scientific development because its evolution has been easily matured by the synthetic conception of its few but cultivated followers who were possessed of wide and sane medical culture and common sense.

And therefore we note that orthodontia, which a few years ago had the simple mission of improving the appearance of the face, now, thanks to the clinic, macroscopic and anatomic pathology, experimental animal pathology, and therapeutics, has not only reached a solid scientific basis that puts it on a level with the other medicochirurgical specialities, but in its evolution follows a path more logical than these, and every day tries to bring relations closer with them and with general medicine and surgery.

And so we see that for the name orthodontia, which has for object the straightening or alignment of irregular teeth, and that answers to the primitive conception of this speciality, some of the cultured orthodontists have substituted that of dentofacial orthopedics, or also of facial orthopedia, wishing to show by this that it is a part of general orthopedics, from which it is divided only for practical purposes, but to which it is united because it is governed by the same laws of biopathology.

In fact, when orthodontists, through their daily work and scientific development, have ascertained that all abnormal positions of the teeth correspond to an abnormal development of the bones of the face, and that the correction of the malocclusion produced the reshaping and the bringing of the bones of the face into their normal form, they have perfectly understood that if the teeth are the organs on which the various orthopedic mechanisms act, it is the bone that transforms itself and regenerates, while the teeth but undergo a simple change of position, and thus they have understood that in the correction of the dentofacial deformities, simple technical ability is not enough, but that a complete knowledge of the physiopathology of the bone tissue is necessary, and for their prevention, a complete knowledge of the laws governing the development of the human organism in healthy and dis-

eased states is necessary. And so a series of useful researches of pathologic anatomy and of experimental pathology has demonstrated how the development of the skeleton of the head is greatly influenced by that of the teeth, that the ogival high palate, that yet today, by competent pediatrics, is exclusively attributed to rickets, it is found, it is true, very often in rickety subjects, but to produce it there must be in addition mechanical actions, such as sucking at the baby's bottle, adenoid vegetations, the sluggish function of the muscles of sucking and mastication, etc. And these facts, these proofs, demonstrate clearly that in the production of skeleton deformities, as also in every other human disease, whether it be infective or of the metabolism, one cause is not enough to produce it, but more causes are always present. First among these is the organic constitutional predisposition, which accounts for all the diseases of mankind. For instance, to produce tuberculosis the presence of *B. tuberculosis* is indispensable, but to develop the disease it is necessary that the human organism be predisposed, otherwise the bacillus of Koch becomes a simple saprophytic bacterium, and therefore innocuous.

And what occurs in tuberculosis happens also in every other infectious disease.

It does not happen differently in skeletal deformities, in the production of which several causes always intervene, but a hereditary predisposition is hardly ever wanting, and a constitutional state of altered metabolism of calcium and phosphorus that goes under the name of rickets.

Some connections between rickets and dentofacial deformities and dental diseases in general, I have spoken of in a paper read before you several years ago on "Syphilis, Tuberculosis, Rickets and Malocclusion," and today I return to this subject, not to repeat what I have already said, but to explain my thoughts on some clinical manifestations that I hold due to rickets, and that may bring a new light on its etiology and pathogenesis. Rickets is a very complex, morbid syndrome, dependent, above all, on altered metabolism of the calcium and phosphorus, and due, according to the most recent studies, to manifold causes: infectious (syphilis, tuberculosis, malaria, etc.); nutritive: (hypo- and hyperalimentation, absence or deficiency of calcium and phosphorus in the aliments and in the water, avitaminosis); physical: (want of sunlight, limitation or want of muscular exercise, etc.); endocrine disturbances, etc.

But to the actual state of this morbid entity, although the pathologic anatomy and the clinic have made considerable progress and have demonstrated that rickets is a constitutional disease, which though it shows in the skeleton, in the teeth and in the muscular system, the most evident pathologic manifestations, strikes at the same time more or less all the organs and tissues of the body, etiology is still uncertain, and therapeutic means, based on this or that, show little efficacy, and consequently prevention is difficult.

However important it be for us orthodontists to know this disease well, it is easy to understand when one thinks that the success of our cure depends in great part on how the bones respond to the mechanical stimuli that we impress on them through the teeth, and therefore one must know well if, and to what extent, the bone can respond to its demands.

It is held that rickets attacks the human organism in the first four years of life, and only exceptionally in a later age, about twelve or fourteen years, and sometimes also even at eighteen years, and in these cases it is called late rickets. But we think that late rickets is more frequent than is believed, because assuming a slighter form in this period, the manifestations of the disease are not easily remarked. And we dentists and orthodontists, who daily work on bone tissue and on teeth, may see some small signs that escape other physicians.

In fact, we often note that in the same individual, and in the course of its development, periods of immunity alternate with periods of great predisposition to dental decay, and again in orthodontic cases in the application of light mechanical stimuli, which in the great majority produce a looseness of teeth in the sockets, we often note that in rickets such looseness is much greater than ordinary, and not proportionate to the degree of the stimuli.

Now these manifestations must be considered as undoubted signs of rickets in childhood and youth, or of a recrudescence of forms of rickets never extinct.

But apart from this, I desire to call your attention, and to hear your advice, on a clinical sign that has already for several years attracted my attention in my daily orthodontic treatments; that is, that in many children after the complete eruption of the permanent incisors, and more often in the central ones, we note a marked retraction of the labial gum, followed by a corresponding destruction of the socket border.

This fact, that I at first thought due to deposits of tartar, made me think of another cause, when in the course of my orthodontic treatments I noted such destruction occurring in young women in their twenties where no orthodontic apparatus had ever been applied. I then made some investigations, and learned that these manifestations were accompanied by general disturbances, such as anemia, weariness, lack of appetite, adenoid vegetations, muscular hypotonia, etc., while such subjects had enjoyed good health up to a little time before.

That the labial gum retraction and consequent destruction of the socket border of the permanent inferior incisors in such cases be expressions of rickets seems to me not only certain, but it makes me recall another dental manifestation which is a sign of rickets, the absence or lack of calcification of the permanent dental germs verified today with astonishing frequency in certain groups of teeth, which are the third molars, the second mandibular premolars and the maxillary lateral incisors.

The involution and disappearance of the third molars has been much discussed and is believed by the majority to be owing to modern civilization, which demands, in consequence of the actual preparation of food, a minor masticatory function; and so the third molar tends to disappear through insufficiency of function; but as for the frequent absence today of the second inferior premolars and the maxillary lateral incisors, we are led to think that it is due, besides, to the absence of dental germs through hereditary factors, also to imperfect calcification of the germs themselves.

I should have wished to dwell longer on this point, but postponing it to another occasion, I shall offer today some brief considerations on the mean-

ing and probable causes of such manifestations. Speaking of rickets, one cannot omit mentioning another disease of the bones, osteomalacia, which is not only another disease connected with it and closely bound to it, but, according to some authorities, is the same disease, with the difference that rickets shows itself, above all, in early age in both sexes, and attacks all the bones, while osteomalacia shows itself in women of adult age, above all in the period of pregnancy, and attacks for preference the bones of the pelvis and vertebral column; and yet in rickets it is the bones that do not calcify, while in osteomalacia it is the bones already formed that decalcify, soften and lose their earthy salts. But these differential characteristics which distinguish the two diseases, considered more attentively, should instead make us admit the similarity not only of the two morbid processes, but should also make us think that the fundamental cause of osteomalacia, like rickets, resides in a qualitative and quantitative alimentary insufficiency. In favor of this hypothesis is the fact that rickets in infancy is caused by the mother not having sufficient nutritive elements for her own metabolism and for that of her newborn child, so that osteomalacia is produced in her and rickets in the child.

In a paper read before the Italian Pediatry Congress two years ago, on "Maternal Nursing and the Dental System," I tried to demonstrate that the great frequency of organic and constitutional diseases in the children of today, among which rickets and dental diseases have the first place, is the expression not only of the improper manner of living of the child, but also the consequence of increased morbidity of parents, especially of the mother during pregnancy and nursing, when the new being takes from the mother all the necessary nutritious elements for its metabolism.

Now it is logical that if the mother has not sufficient reserves of calcium, phosphorus and magnesium, which are the fundamental elements of the bone tissue, or does not introduce enough of them into the daily alimentation for the double balance, we have osteomalacia in the mother and rickets in the child.

In fact, in many women of today, we notice that during pregnancy and nursing, they are affected with dental diseases (caries, loosening of teeth in their sockets, pyorrhea, etc.), which cease with the termination of the pregnancy and nursing, to begin again with another pregnancy and nursing, from which the common saying: "every child a tooth," while in the child of present generations we notice an impressive frequency of caries of the first permanent molar, which is the tooth that calcifies just at that time.

And so, in concluding, we may affirm:

(1) That the destruction of the gum and corresponding labial alveolar border which we find in the inferior central permanent incisors at their eruption, and some time also many years after, must be considered as a sign of rickets.

(2) That osteomalacia of the mother produces rickets in the child.

(3) That osteomalacia and rickets have their most important cause in improper alimentation as regards quantity, quality and proper preparation.

# PHYSICAL LAWS AND THE DESIGN OF ORTHODONTIC APPLIANCES*

By H. T. McKeag, B.D.Sc.U., Dublin, Ireland

McCOY defines an orthodontic appliance as "a mechanism for the application of pressure stimuli to malposed teeth to bring about the reactive processes in the bone, which allow tooth movement in the direction desired and the development required to support the teeth in normal occlusion." We have thus to use mechanical means to achieve a physiologic end, and our appliances must obey mechanical as well as physiologic laws. Indeed, physiologic efficiency very largely depends upon mechanical efficiency. The purpose of these notes is to collect some of the available material for the establishment of the mechanical principles which should govern the design of orthodontic appliances.

When we examine the nature of orthodontic appliances in general, we find that their design must be adapted to fulfill three functions:

Pressure production;
Distribution of pressure action and reaction;
Support.

It is possible to combine two or more of these functions in a single part, but the functions are independent and require to be analyzed separately. The last of these, support, is purely passive, and I do not propose to say anything of it.

## PRESSURE PRODUCTION

It is possible to liberate pressure in a number of ways, but for the purposes of orthodontic stimuli we are limited, for the present at any rate, to the principle of elasticity, and in practice it is found that the most convenient storehouses of this form of energy are rubber and certain metals. In using these we have to control their output in its amount and its direction, so we require to know something of the physical laws which govern that output. These laws are the same for all elastic substances, but as rubber and metal are used in quite different ways, it is best to deal with them separately.

Rubber degenerates rapidly under working conditions in the mouth and would be disqualified on that account for orthodontic use were it not that it possesses in an exceptional degree two qualities, high elastic limit and low modulus of elasticity. These fit it for use in extension and contraction where pressure has to be transmitted between two points which must move freely relative to one another, as is the case in intermaxillary traction. These qualities, however, confine its use to extension and contraction, so that we

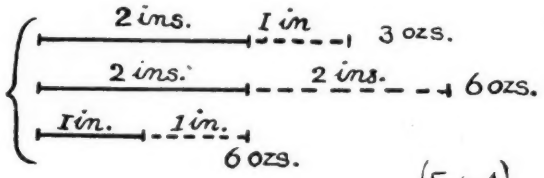
*Read at a meeting of British Society for the Study of Orthodontics.

are only concerned here with its behavior under those circumstances. It will suffice, then, to state that within its elastic limit the pressure exerted by a piece of rubber is proportioned directly to its extension and to the fourth power of its diameter, and inversely to the length. (Fig. 1.)

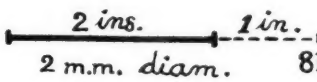
It is with relief that we turn to metal as a source of elasticity, for we can choose it to be completely stable in its properties in the mouth, and to have almost any desired compromise between elasticity, rigidity and toughness, and further, to be capable of easy utilization in appliances.

In order to utilize the elasticity of metals we give them certain forms which we call springs; we discard the more complicated, such as helical and volute, on grounds of uncleanliness, and use the simple forms we may describe as cantilever, beam and arch.

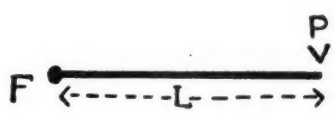
The cantilever spring, for our purpose, is a strip of elastic metal fixed at one end, free elsewhere, and for dealing with its behavior I am going to




(Fig 1)




$$\text{Pressure} \propto \frac{\text{Deflection} \times \text{Diameter}^4}{\text{Length}^3}$$




(Fig 2,

assume first the simplest case—that the spring is straight, is of uniform material and uniform circular section, and with a single deflecting pressure applied at right angles to its free end. Then its behavior will be according to the formula

$$\text{Pressure } a \frac{\text{deflection} \times \text{diameter}^4}{\text{length}^3} \quad \text{(Figs. 2, 3, 3A.)}$$

That has some appearance of complexity, but it is merely a short statement of three simple relations. If we express it to show separately the effect of a variation in each factor, keeping the remaining factors in each case constant, we find that:

Pressure varies directly with the amount of deflection;
Pressure varies directly with the fourth power of the diameter;
Pressure varies inversely with the cube of the length.

One must note, of course, that these only hold good so long as the pressure is not sufficient to cause a *permanent* change of form in the material.

In the mouth we cannot always use this simplest form of the cantilever spring, and the most usual divergence from it is that the spring is not straight, but curved or twisted in some degree. The formula given will hold good in these cases if we can find what is the *effective* length of the spring and substitute it for *length* in the formula. It may be advisable to point out, by the way, that length, and effective length, are always measured from point of fixation to point of application of pressure.

Fig. 4 represents an exaggerated form of a spring we often use, and it will be noticed that the effect of curving it is to reduce its effective length, and consequently to raise the pressure exerted.

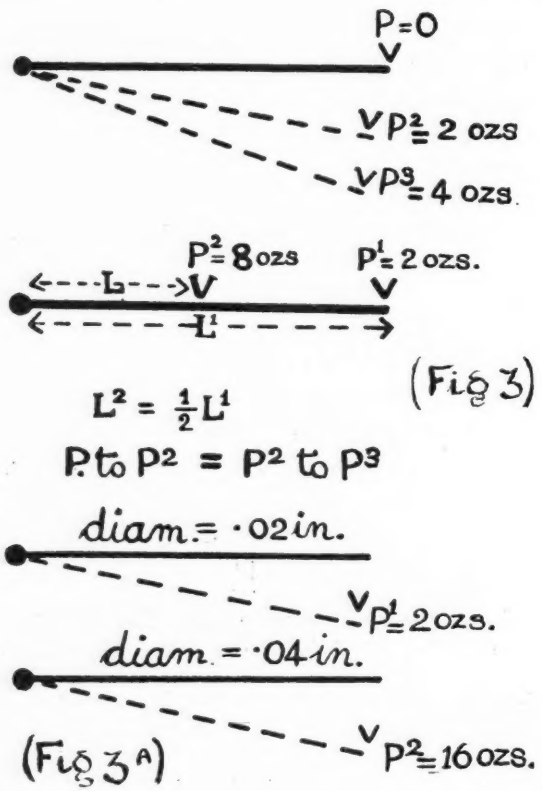


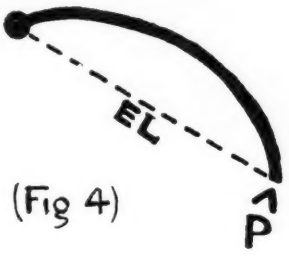

Fig. 5 represents a form used in a variety of ways. Analysis of its form shows that we have to treat it as two springs, one, AC, with its fixation point at A, and one, FB, so that the effective length will be $\sqrt[3]{113 + 123}$. Thus the result of doubling the actual length in this way is not to decrease the pressure to one-eighth, but approximately to halve it.

Fig. 6 is another common form, and here again we have to get the effective length by analyzing actual length into two springs which overlap by introducing the twist. Here we have increased the effective length as compared with a spring running straight from the point of application to the point of fixation, but not by the whole amount of additional spring material added. The additional effective length is small in itself, but if the actual distance from the point of fixation to the point of application is very short and we make the twist as large as possible, the reduction of pressure, or

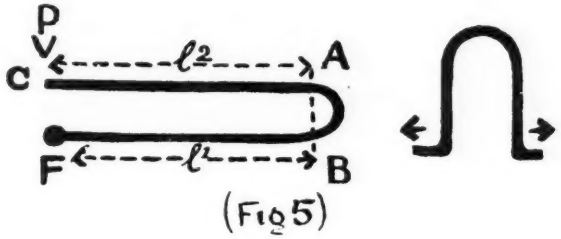
alternately the increase of deflection for a given pressure as compared with a straight spring, will be very important.

If the change of form involves taking part of the extension of the spring out of the plane of the pressure, torsional elasticity is brought into play (Fig. 5A, with pressure at right angles to plane of slide), and its effect is on the same lines as deflectional elasticity, though the actual mathematical effect of similar changes of form in different planes is somewhat different.

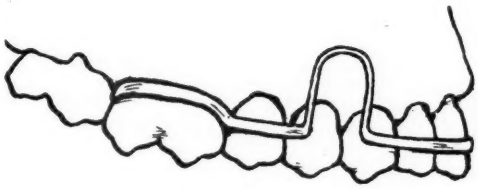
As a sufficient guide for estimating the effect of changes of form from the straight in cantilever springs, it may be taken that so much of the actual

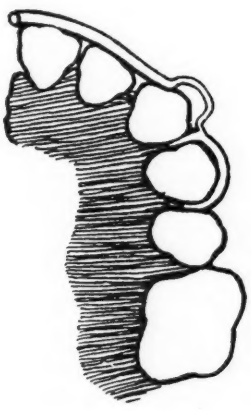


(Fig 4)



(Fig 5)

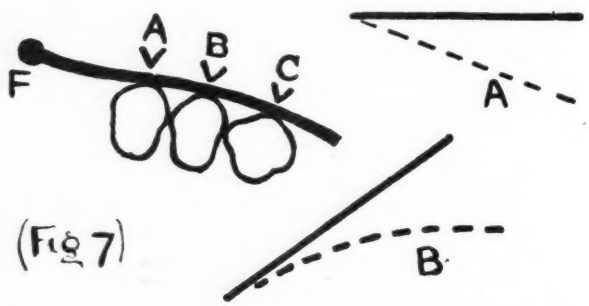



(Fig 5A)

length as is at right angles to the direction of pressure is effective, but that where the direction is reversed the sum of the effective lengths of the two or more parts of the spring are to be taken as the effective length of the whole spring.

I have been assuming so far that pressure is applied to the spring at one point only, or to translate into orthodontic practice, that the spring is working on only one tooth. But it is common to find such a spring applied to a number of teeth at once, as where a lingual arch with auxiliary springs is used for expansion of the canine and premolar regions. It is possible to analyze theoretically the distribution of the pressures between the various

teeth, but only on the assumption that the points of contact are exactly on the natural line of the deflected spring, since the most minute deviation in this respect will completely alter the distribution. As this condition cannot be fulfilled with certainty in the mouth, it is only necessary to say that the more distant are the points of application from that of fixation, the more even will be the distribution of pressures, and vice versa. It is important to notice also in this connection that since the deflection varies inversely with the cube of the length, the maximum travel of a tooth close to the point of fixation will be extremely small as compared with that of a tooth remote from the point of fixation. In the case in Fig. 7, if FC = 3 cm. and FA = 1 cm., then when the travel of C = ½ cm. the travel of A will be only $\frac{1}{54}$ cm. Hence, if one requires to get anything approaching equality of travel of these teeth, one must either choose a fixation point for the spring acting on them at a considerable distance, or, as is commonly more convenient,

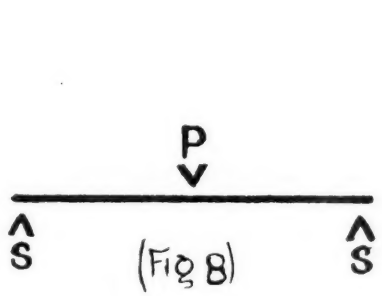




make the spring of such form that the effective length between the point of fixation and the nearest point of application is considerable, e.g., by introducing some form of twist.

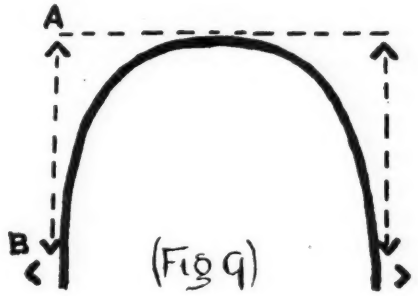
What I have called a beam spring is similar to the cantilever except in one respect, that the two ends are supported. (Fig. 8.) This little modification introduces an important difference in the behavior of the spring, in that where the pressure is applied midway between the points of support we have to substitute "deflection × 16" for "deflection," with the result that we have to increase the pressure sixteen times for a given deflection, as compared with the cantilever, or for a given pressure get only $\frac{1}{16}$ of the deflection.

In the expansion arch we have a type of spring which I have called the "arch." (Fig. 9.) It does not really differ, when used for expansion of the lateral teeth, from any other form of the cantilever spring, and the original formula holds good, the effective length being the sum of the effective lengths of two perpendiculars dropped from the points of application to a tangent drawn to the curve at a point midway between the points of application.

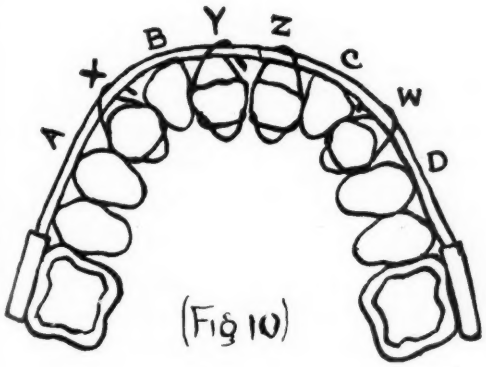
But this type of arch is used in quite a different way and its behavior completely altered. It is used for labial movements of the anterior teeth as in Fig. 10, and its behavior then becomes extremely complicated. For we have three beam springs, AB, BC, CD, and the pressures exerted by these are not independent of one another, for if a pressure be applied first at X, then the pressures required to obtain a given deflection from the initial position at Y and Z will be increased, since XZ is in effect a lever with fulcrum at B, and the deflection at X will be reproduced in the opposite direction at YZ to an amount proportionate to the distances of the respective points from the fulcrum; and it follows that the application of a pressure at Y will increase the pressure at X, in fact, if the distance BX equals the distance BY



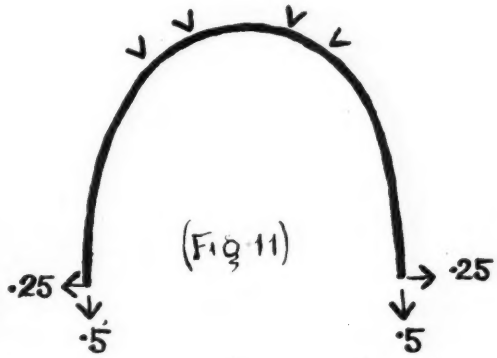
(Fig 8)



(Fig 9)



(Fig 10)



(Fig 11)

the pressure at X will be increased by the amount of the pressure applied at Y. Further, this system of springs and levers is complicated by the existence of points of attachment at the ends of the arch, to the molars, and every pressure applied at any point of the arch will be reflected in some degree and in some direction at these points. We can analyze the effect here best by taking a simple case, as in Fig. 11. Here pressure is applied at four points distributed more or less symmetrically over the curve of the arch, and it is found experimentally that their effect at the bases of the arch is as if two-sixths of the total pressure were applied to each base in a backward direction and one-sixth to each in an outward direction.

We have been dealing so far with *variations* in pressure, but in order to apply the laws governing these variations we must have an idea of what actual amounts we require for our particular purpose. How low can pressures be made and remain effective; how high can they be made without

causing damage? It must be said at once that absolute answers cannot be given, but there is a certain amount of evidence to show the range within which pressures may vary.

In regard to the lower limit, I will state quite boldly that I believe it to be fixed in practice not at the point where pressure is insufficient to provide stimulus to movement but by the necessity of making springs stable under working conditions in the mouth. I have used successfully initial pressures as low as ¾ oz., and in the scores of cases tested movement has continued until the pressure exerted was so low that I have never found it possible to measure the pressure exerted when movement ceased. That leaves open, of course, the possibility that a higher pressure is required to start movement than to continue it. That is an interesting subject of speculation, but I believe really unimportant, because the springs which will apply these very low pressures over any considerable range of movement are unsuited to general use because they are liable to displacement by the action of the tongue, cheeks and mastication. In practice I find that an initial pressure in the neighborhood of 2 oz. is a convenient one for application to a single tooth; though where the spring is well protected from extraneous stresses I make use of lower pressures. Probably when distributed over a number of teeth the average per tooth is rather less.

You would naturally like to have some support from others before accepting these figures. I am afraid I can bring little evidence from other orthodontists on this subject, which appears to have been somewhat neglected. But Ferris, in the *Journal of the American Dental Association,* gives figures ranging from 0.6 lb. to 1.2 lb. for forms of appliance intended, so far as I could understand the article, for lateral expansion of the whole arch of teeth. If I interpret him rightly, the average pressure per tooth would be about from 1 to 2 oz. Irish, in the *Proceedings of the International Orthodontic Congress,* shows initial pressures ranging from ¾ to 6½ oz., though he gives no indication of what these pressures are capable of doing. From his illustrations one would judge them to be the routine amounts used in practice with lingual arches and expansion arches.

Now I do not wish to be understood as stating that a pressure of 2 oz. will always cause movement of the tooth to which it is applied. My statement is that I believe that amount to supply an ample stimulus. But very frequently mechanical obstacles to movement will exist, as where a maxillary incisor is locked in a lingual position by the bite of the mandibular incisors. Now it is possible generally to overcome the mechanical obstacle by increase of pressure, and I have no hesitation in doing so up to two or three times my standard 2 oz., where I am satisfied that my anchorage will stand the increase. Lips and cheeks may also provide counter pressures which must be neutralized before movement can be obtained. I think it is clear, however, that the additional pressures required in these cases are merely neutralizing opposing pressures, and are not required as *stimuli.* (Fig. 12.)

Now the question arises, how is speed of movement affected by amount of pressure? I find it impossible to get sufficient evidence on which to base

a positive opinion; but the indications seem to be that at very low pressures movement is less rapid than, in the same individual at the same time, it would be with somewhat higher pressure, but that raising the pressure beyond a certain quite low point does not bring about any increase of rapidity of movement. In fact, I will offer a tentative opinion that 2 oz. per tooth supply ample stimulus for the utmost rapidity of physiologic movement of which bone cells are capable. It seems as if there is a certain rate of bone cell activity for each individual at any one time, and that this can be put into full operation over a certain area of bone by a certain quite low stimulus, but that the individual is incapable at that time of a greater rate of cell activity no matter what the stimulus. On this supposition an increase in the area of bone to be brought into activity would necessitate an increase of pressure up to a certain point, but beyond that no advantage would be gained.

The rate of movement, at any rate, does vary in different individuals and in the same individual at different times, and the question arises, are we justified in trying to hasten slow movement by piling on pressure? That we can do so is, I think, certain, but the increase required is enormous, and the resultant movement, I believe, a pathologic one. We get conditions favorable for movement of this sort in appliances adjusted by screws, in which the only source of elasticity is the supporting tissues of the teeth, principally, one supposes, the peridental membrane, but probably also the bone to some extent. Now the range of movement given by a single adjustment where we are dependent on such a source of elasticity is obviously extremely small, so that even if the initial pressures are quite high very frequent adjustment will be required in order to make the series of intermittent pressures overlap and so approximate to a continuous pressure. And there is a very real danger that, where the teeth are not, so to speak, willing to move, repeated adjustments will build up an extremely high pressure, as the screw is, mechanically, well fitted to do. Movement will be brought about, but it will be movement by damage, with or without repair. The difficulty with such an appliance, in which one cannot estimate even approximately the pressure which is being used, is to know whether the teeth are moving under persuasion or compulsion.

When we come to the upper limit of pressures, the position in regard to evidence is even more unfavorable. Oppenheim produced, apparently, thrombosis in the periodontal blood vessels and other unfortunate results, by what he calls "excessive" pressures, but he gives no indication of what the amounts were. Naturally no one cares to experiment in that direction on human beings, and those who have reached the limit unintentionally have not, at any rate, published the amounts. Fortunately the recuperative powers of the mouth are considerable, so that it is doubtful if gross permanent damage is frequently done nowadays by excessive pressures. The common sense of the subject seems to be, as Mr. H. Chapman has said, "If a low pressure suffices, why use a high one?" And indeed the use of high pressures actually entails such disadvantages that it is surprising that any one is ever tempted in that direction. For in addition to the pain frequently associated with them,

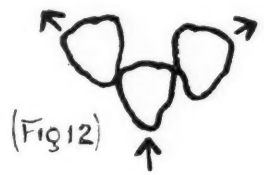
there is the handicap that the short thick springs which produce them will not give considerable amounts of movement without repeated adjustment, resulting not only in inconvenience but in loss of continuity of pressure. It seems to me that there one touches on one of the two essential factors in easy rapid movement of teeth—the necessity for continuity of the stimulus, and that belief is based not only on experience but on the theoretical ground that when one applies a stimulus the bone cells have to change from a resting to an active state before movement can begin, and on cessation of the stimulus the cells are transformed to the resting state, so that a series of intermittent stimuli acting over a very short range tends to keep the cells in oscillation between rest and action without producing the movement which should result from the action of a single stimulus acting over a wider range.

To summarize my views of orthodontic pressures in respect of quantity and means of production: I do not, of course, advocate measurement or calculation for each appliance, but that the orthodontist should have an idea of the pressure exerted by some standard piece of his spring material, with such a knowledge of the laws governing the behavior of springs that his judgment of whether an appliance will exert a "sufficient" or an "excessive" pressure will be automatic. We have certainly wide limits within which we can allow pressures to vary. And I would suggest also that in order to get continuity of stimulus over as much as possible of the necessary travel of the teeth, sources of elasticity should be chosen of such a nature that they give low pressure under large deflections within the elastic limit. The conditions necessary for this are generally high elastic limit of material, considerable effective length of spring, and small thickness of spring.

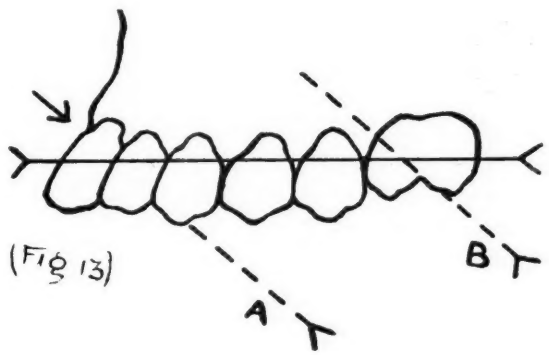
## DISTRIBUTION OF PRESSURE ACTION AND REACTION

The second function of an orthodontic appliance, as I analyzed it at the beginning, is the distribution of the action and reaction of the pressures stored in the source of elasticity, and it is in the design of this part of an appliance in order to secure efficiency that the greatest difficulties arise. Two physical laws stand out as of importance to us here: first, that every action produces a reaction equal in amount and opposite in direction, so that every time the orthodontist makes use of elasticity in the mouth he is liberating two pressures, one which he wants, one which he very often does not want. The amount and direction of both of these must be taken into account in the design and adjustment of every appliance. In regard to amount, the subject of these unwanted reactions has been fairly adequately dealt with, but in regard to direction difficulties arise which have not been properly explained. They result from the operation of a second law, that the action of a pressure applied to a smooth inclined plane is at right angles to the surface of the plane. Now the surfaces of the teeth are, for practical purposes, smooth, and they abound in inclined planes, planes that are inclined relative to one another, and especially relative to planes in which we wish to move them. Movements are commonly required in the plane of the arch, consequently our pressures are arranged to act along the plane of the arch, and

indeed the necessity of maintaining function in the mouth makes it somewhat difficult to arrange pressures in any other plane. Now when these pressures are applied to surfaces inclined relative to that plane, their effect is diverted into a different plane. A very common case of this is shown in Fig. 13. Here we wish to move the central incisors lingually, using the first molars as anchorage. Strictly analyzed, the path taken by any point on the crowns of the teeth to be moved should be represented by the arc of a circle having its center approximately at the apex of the tooth concerned, but in effect it is as if the crowns of the centrals were to be moved along the plane of the arch, that is, the action and reaction should be as indicated by the solid line. But if we actually apply the pressure along this plane, the inclination of the labial surfaces of the centrals diverts the line of action and reaction to the plane indicated by the dotted line. Now the effect of the reaction of the labial



(Fig 12)

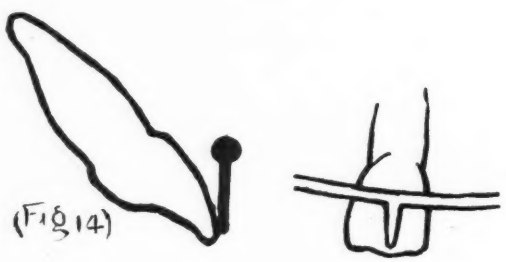



(Fig 13)

surface of the incisors is transmitted by the appliance to the first molars, consequently the tendency of the reaction is to tilt these teeth upward and forward as shown by the dotted line B, parallel to the line A. Incidentally, of course, the effect of the action of the pressure on the incisors is tending to move them in a direction downward and backward in a proportion determined by the angle of the plane of action and reaction to the plane of the arch, but as they have considerably more resistance to downward than to backward movement, it is only where the angle between the two planes approaches a right angle that there will be any tendency to elongate the incisors, and before that happens it will almost inevitably be the case that the reaction will have tilted the molars. The result of tilting of the molar, or of whatever anchorage there may be, is to allow the appliance to slide up the incisor. This is but one example; we meet the same tendency in applying a lingual arch to move labially the maxillary incisors, the lingual surfaces of which are inclined to the plane of the arch; and I am sure everyone can multiply instances.

One can see three ways of overcoming the difficulty:

(1) Apply the pressure to a surface which is at right angles to the plane of the arch, by choice of surface to which the pressure is applied, as in Fig. 14. Here the spur transfers the pressure from the upper, inclined part of the labial surface to the incisal part of that surface which is commonly much less inclined. It is not practicable to bring the whole labial arch down to the incisal part, as it interferes with, and is itself interfered by, mastication. It is to be noted here, and the rule holds good for all appliances, that where action or reaction is transmitted through an appliance from one part of the mouth to another, that part of the appliance must itself be sufficiently rigid not to be displaced under working conditions in the mouth, since were it displaced, the angle at which the action or reaction should be transmitted would be altered. Here, flexibility of the labial arch will allow the spur to slip upward onto the inclined portion of the surface.



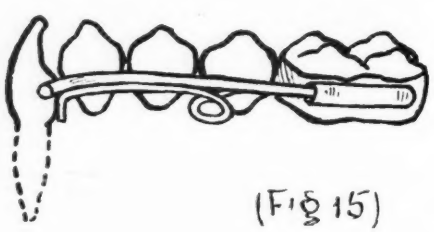
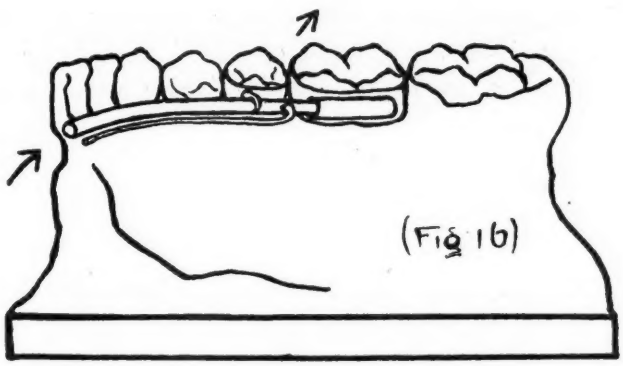
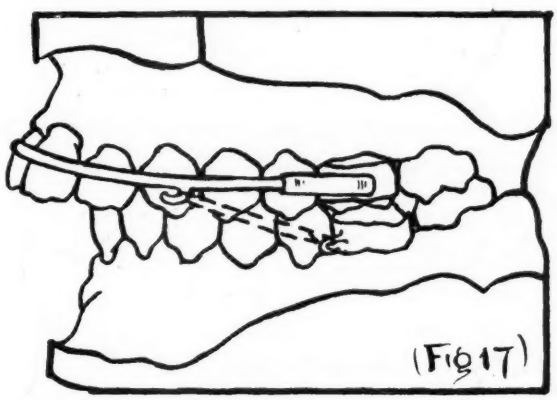



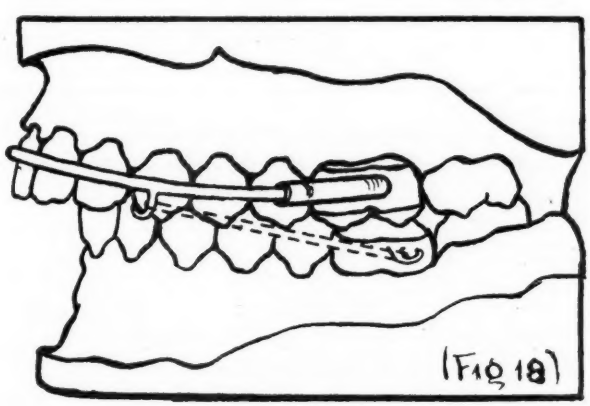

Fig. 15 shows another case of the same type. By bending the end of the auxiliary spring at right angles to the spring, pressure can be brought below the level of the gum edge onto the vertical lingual surface of the cingulum. Here again the proportions of the lingual arch must be such as will not allow the spring to slide incisally onto the inclined surface. It is possible, of course, also to convert a surface that is inclined to the plane of the pressure to one at right angles to it by a suitably shaped band.

(2) One can make the resistance to the unwanted part of the pressure exceed by a considerable amount that to the useful part. For instance, in Fig. 16 the auxiliary spring, being applied to the inclined lingual surfaces of the mandibular incisors, tends to tilt the lingual arch, and consequently the first molars upward and backward. A band and spur on the second premolar, engaging the lingual arch, will add the resistance to elevation of the premolar to the resistance to tilting of the molar, so that though the unwanted reaction remains, the resistance to it is likely to be greater than the resistance of the incisors to labial movement.

(3) One can make the plane of pressure at right angles to the surface to which it is applied. That of course commonly involves taking the plane of the pressure out of the plane of the arch, and one of the most convenient methods of doing this is by the use of intermaxillary elastics, as in Fig. 17.




Here the attachment of the elastics to the upper and lower appliances is so arranged that they, and consequently the pressures they apply, are approximately at right angles to the inclined labial surfaces of the incisors. Obviously, as the incisors are tilted lingually the labial surfaces will assume positions less and less inclined to the plane of the upper arch, so that eventually they will have become inclined relative to the direction of pressure to an undesirable extent. The effect will be that the pressure transmitted

through the labial arch will tend to tilt the anchor teeth downward and backward, so that it is necessary, as the incisors move, to bring the line of pressure again at right angles to the labial surfaces of the incisors. This is readily done, of course, as in Fig. 18, by bringing the upper attachment of the elastics forward and downward and the lower upward and backward. This method does not involve any difficulties with unwanted reactions in the mandibular teeth provided the lingual or labial arch is so arranged as to distribute the reactions over the mandibular incisors and canines as well as

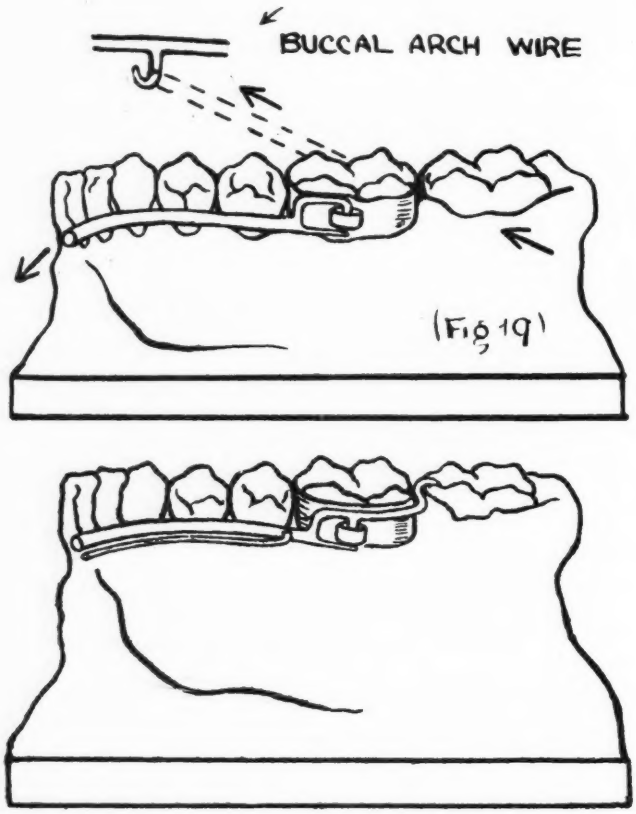



Fig. 20.—Suggested alternative for stabilizing molar anchorage.

the molars. One can even use these reactions at times, as in Fig. 19, to reduce a moderate close bite.

DISCUSSION

The *President* inquired what means Mr. McKeag used for strengthening the pressure on his springs. Mr. McKeag brought out in the paper the essentials of correct construction —a familiarity with the appliances used, and the ability to adjust them and make them correctly. The members, he thought, would now appreciate what they owed to the firms which produced some of the finest wires, and also what they owed to the men behind those firms—the metal workers and drawers, in producing such a wonderful tensile strength.

*Mr. Rt. Lindsay* thanked Mr. McKeag for what might be described as a postgraduate discussion of certain studies which most of the members were beginning to forget—he meant their physics and their metallurgy of earlier years. He had the reflection that if those who taught physics and metallurgy to dental students would illustrate their teaching by practical dental examples, such as the members had been looking at on the screen that evening, those

subjects would be very much more interesting and more useful to dental students; and many of those present would not have arrived at their present age destitute very largely of an intimate knowledge of the things about which Mr. McKeag had been talking. He had been rather astonished to find that Mr. McKeag had not included the screw among those agents which might be used to apply orthodontic pressure, especially as it had been associated with the name of a very prominent member of the Orthodontic Society. Mr. McKeag had remedied that to some small extent in the latter part of his paper by condemning the screw out and out; it seemed to him (Mr. Lindsay) that Mr. McKeag had the same objections to the screw wrongly used as one might have to the spring wrongly used, and that there was still something to be said for intermittent pressure in orthodontic practice. It had to be remembered that Nature, in so far as they understood her methods, especially in the growth of bone and other structures, did act in an intermittent way; a violent phase of activity was succeeded by a quiescent stage. Therefore, there was something to be said for the action of the screw. It was interesting to note, with regard to rubber, that they were dealing with inherent elasticity—an inherent property of the material, while with regard to the metal springs they were not dealing with the inherent elasticity which every metal possessed, but with an acquired elasticity due to the form of the metal or the treatment which it had undergone; he would not be inclined, as a metallurgist, to endorse the President's thanks to the tradespeople for having relieved practitioners of so much of the necessity for understanding the properties of materials. He thought it would be much better if practitioners were forced to discover by experiment and use the properties of the metals and the manner in which they should be applied. He had been very much interested in that definition of orthodontic force which Mr. McKeag had given in which he referred to orthodontic pressure as being meant to stimulate movement in the bone. That, it appeared to him, was one of those essential things which orthodontists were sometimes apt to forget. They aimed at the stimulation of movement in the tooth, and then disaster sometimes came. Was it not getting more and more to be recognized that the orthodontist had, as his main object, the stimulation of the growth process which might have been slowed up or arrested from some reason or other in the denture, and that pressure therefore should be of a nature simply designed to awaken the natural forces in the bone to their proper work, and to assist those forces to such a degree as was possible? He thought that if orthodontists accepted that idea with regard to orthodontic work, there would be fewer of those failures which even the least candid were inclined to admit, and there would be less risk, in after years, of periodontal disease.

*Mr. G. Northcroft* congratulated Mr. McKeag on his presentation of the subject, which would prove the more valuable the more it was thought about. One point had struck him as being of interest, and that was the reduction in diameter of the loop of the labial arch which was shown early in the paper—was Mr. Keag in the habit of soldering in a sectional loop of a smaller diameter, or how did he reduce the diameter of the loop? It seemed a sound idea, in that it obviously increased the resiliency of the arch while maintaining rigidity. He himself was also among the many practitioners who had on occasions found use of pressure by screws very advantageous, and he could not agree with Mr. McKeag in his condemnation of that method of applying pressure. The more practice one had with auxiliary springs, the more one noted the extraordinary efficiency of a very small amount of pressure. Another interesting point brought out was when a tooth had to be moved in or out of an arch, one had sometimes to take into consideration the distributed pressures over more than one tooth; therefore it was legitimate to increase the pressure of a spring, but one did not necessarily increase the pressure on the particular tooth because the pressure became distributed over more than one tooth.

*Mr. Badcock* also thanked Mr. McKeag for his paper. He gathered that one of Mr. McKeag's objections to the screw was that it was difficult, or impossible, to gauge the amount of pressure one was using. He thought it could be summed up quite simply as follows—that if the tooth became the least degree tender one was using too much!

*Mr. H. Chapman* said that one could quite understand that Mr. McKeag had been able to improve the efficiency of his appliances, after the demonstration which he had given that

evening. He, too, had experienced the same phenomenon as Mr. McKeag, namely, how the rapidity of the occlusal changes varied in individuals. One seemed sometimes to be treating a case for twelve months, and very little happened; and then in the next three months there was suddenly a complete transformation without one having done anything in particular. It seemed that during that time there had been preparatory changes in the tissues to enable those things to happen suddenly, as it were. Mr. McKeag said, "The ill results are seen more in the reactions that in the actions, so that the anchor teeth are tilted." If Mr. McKeag was referring there to the use of intermaxillary traction they were not thinking of the same thing. It had only just occurred to him that the reference might be particularly to intermaxillary traction. It seemed to him rather difficult to gather how the reactions in the anchor teeth would occur to such an extent to tilt them, unless the apparatus were not fitted so that it was at rest on the anchor teeth or would produce only desired movements. In that case one would have the auxiliary springs—supposing one were moving the teeth by auxiliary springs—moving the anchor teeth. He quite agreed that that was possible, but he should think it very rarely happened unless appliances were misused, and he did not believe Mr. McKeag did that. It was possible in the course of attempting to move mandibular incisors forward against maxillary incisors (the overbite being excessive) which were not going forward at the same time. Then he had seen the molars go back. In only two other cases, in which he did not suspect the overbite as a contributory cause, had he seen that happen. The second deciduous molars were the anchor teeth, and a space would repeatedly occur between the second deciduous molars and the first deciduous molars. The cause of that he had never been able to satisfy himself upon. He had wondered whether Mr. McKeag tended to eliminate the use of bands for auxiliary purposes as he did, and he suggested for the purpose of preventing the molar teeth tipping, instead of a band on the premolar, that the same effect could be got by soldering to the band or to the end of the arch a piece of wire which extended distally and rested in the lingual sulcus and just on the occlusal or distal surface of the molar behind. The way in which the maxillary anchor teeth tilted during the use of intermaxillary traction seemed to him to bring the distal aspect of the teeth to a lower level than the the teeth behind, and if the latter could be used as a source of anchorage the extra band could be eliminated. He desired to ask McMcKeag if he had used the auxiliary spring for moving mandibular incisors forward without shortening them. He was thinking of the one which impinged below the margin of the gingiva, and whether that could not be made effective over two or three teeth by soldering short vertical spurs to it. That was one of the difficulties arising from the use of auxiliary springs—that an auxiliary spring in moving mandibular incisors forward in nearly every case tended to depress them, and personally he had not been able to find a satisfactory way of dealing with it. It was interesting to bear in mind in regard to these stresses that Lourie used appliances in which the anchor portion of the appliance was a thin auxiliary spring wire, and that the other portion was a thick gauge wire. It showed how all these things could be reversed if one cared to think about them. He was extremely indebted to the author for his very admirable paper and his excellent illustrations.

*Mr. McKeag,* in reply, said the President had asked a question as to how the pressures given were tested. He hoped the members would not be shocked when he said that a great many of them were tested with an ordinary letter weight. He did not think the degree of accuracy necessary was very great. Some of the pressures were tested with Dr. Friel's dynamometers. In the *Proceedings of the International Orthodontic Congress* there was a description of a very complicated appliance for testing the pressures exerted by orthodontic appliances. Although he would be extremely interested to have such an instrument, he did not think an elaborate appliance like that was necessary. A variation of ¼ oz., as one might easily get in testing pressures with somewhat crude means, would be of no importance at all.

Mr. Lindsay had raised some very interesting points—first of all about the screw. He hoped he had not made himself to appear to condemn the screw completely; the point he had wanted to make had been that it was extremely difficult with the screw to estimate how much pressure one was applying. Certainly one could estimate that to some extent by the tenderness of the teeth; but there were two objections to that—one was that some children would cry hurt when there was no excess pressure on the teeth at all, and other children

were very heroic and would make no complaint even if the teeth were extremely painful; and the other objection was that screw appliances were very commonly used not under the adjustment of the dentist at all, but under the adjustment of the patient; and children would go on adjusting and adjusting, and there was nothing to show whether the teeth were being moved under compulsion or under persuasion. There was a misconception about the screw. The screw could not generate pressure at all. It could not even store pressure. The only thing the screw could do was to adjust pressure. It could only adjust the pressure which was generated by elasticity in something else. In a rigid screw-adjusted appliance the elasticity could only come from tissues themselves—from the periodontal membrane or the bone. That was the theoretic objection to a screw—that the range of movement which could be obtained from a single adjustment dependent on elasticity from those tissues must be very small, unless the pressures were made enormous.

Intermittency, as Mr. Lindsay had said, was a characteristic of growth, but it was intermittence in quite a difference sense, in that the periods were much longer than intermittences as he understood it in orthodontics. Nature did not, as he understood it, bring intermittence to the point to which it was brought in, say, an appliance adjusted by a screw. Nature's periods were very much longer. A child might have a period of active growth of two or three months but not for a couple of days, he thought.

Mr. Pitts had raised the subject of knowledge of physics and the teaching of physics, in opposition to Mr. Lindsay's views on the subject, and had suggested that a book of formulas should be produced. The position so far as he himself was concerned was that he had been taught—or, rather, he had been expected to learn—mechanics as an undergraduate, and he had been extremely poor at it. He remembered one examination at which he had failed to achieve any marks at all. At the viva voce examination the examiner had said to him, "I am afraid mechanics is hardly your subject," and he quite agreed with him. But the knowledge which he had gained, although apparently he had forgotten it all, had been at the back of his mind all the time and, more or less unconsciously, had been guiding him in working with orthodontic appliances. Merely to have known something about mechanics at one time gave one an eye for judging what an appliance was doing, and that, he thought, was what a practitioner wanted; he did not want to measure angles and pressures, but wanted to get a knowledge which would enable him properly to judge what his appliances were doing. Mr. Pitts raised the question of how these formulas could be applied to the ribbon arch. The material being elastic metal and the shape of the ribbon arch being comparable to the examples he had shown, the main formula which he (Mr. McKeag) had given applied in just the same way, except that for diameter one had to substitute the breadth multiplied by depth cubed. It had occurred to him that it might be useful, when the paper was published, to give the mathematics as a sort of appendix, but they were not interesting in themselves and quite unessential for the purposes of the paper; but it might be of some assistance if they were given as an appendix.

Mr. Northcroft had asked about the illustration shown, where the diameter of material in a loop for a labial arch was reduced. When he did that he did it by soldering in a piece. He found that a joint could be made quite strong by overlapping the two pieces. He did not find it necessary to make the anterior part of the labial arch in those circumstances any thicker than the loop. The part which was subject to severe stress was that which was attached to the body of the appliance, and that was only transmitting pressure and not storing pressure—it was not being used as a source of elasticity, so it could be made as thick as was convenient. What he had been doing lately in the way of that type of appliance was to use a stout piece of metal for the posterior part of the labial wire, and soldering to it a length of much thinner wire, generally about 0.26 or 0.28 in. That formed the loop and also the anterior part of the arch.

Mr. Chapman had raised some points which, he was afraid, he would have considerable difficulty in dealing with. He quite agreed that one did quite commonly get rest periods in children. Nothing seemed to happen, no matter what one did, and it was just that sort of thing which tempted one to build up pressures. He himself used to do that, and twiddle about with the teeth, but he had not given it up. If teeth would not move, he left them alone, and he found if he left them alone progress might be slow, but it went along just as

well as if he fussed about with them, and it gave him an easy mind that he was not putting great pressures on the teeth. He had never found, short of increasing the pressures to an enormous extent, that increase of pressure was of any benefit in speeding up movement.

With regard to the tilting of the molar anchorage under the reactions, it had come to his mind when he had been preparing the paper, because he had had some time ago some most unfortunate experiences in that direction; and it had been the working out of the cause of those experiences that had put him on to trying to get at the mechanics of what controlled the direction of actions and reactions on inclined incisors. The illustrations he had given were purely illustrations; they were not at all intended as an exhaustive list of the possibilities. They were merely illustrations of the three principles which he had attempted to formulate for the means of overcoming the results of those unwanted reactions due to the inclination of the planes of the teeth relative to the plane in which one wanted to move them. With regard to the spur band of which Mr. Chapman spoke, he thought he had only used it once in his life. He did not intend it to be taken as a thing he particularly recommended. It was simply an illustration which had occurred to him of a means of increasing the resistance to the unwanted reaction. He was quite sure there were much better means; in fact he much preferred the means which Mr. Chapman had suggested for overcoming the unwanted reaction in that particular case.

With regard to using spurs soldered to an auxiliary spring for labial movement of mandibular incisors without depressing them, he thought the difficulty was purely a technical one. If one could solder the little spurs in exactly the right place, and at exactly the right angle, he was sure it would work admirably. Certainly it had been of enormous assistance, in moving individual teeth, to turn a very short length of the end of the auxiliary spring, so that it got just under the edge of the gum, as shown in the illustration, to bear on the vertical surface rather than on the inclined surface which ordinarily presents itself above the level of the gum on the lingual surfaces of incisors.

# APPLIANCES AND METHODS EMPLOYED IN CLOSING SPACES RESULTING FROM LOSS OF FIRST OR SECOND PERMANENT MOLARS*

By Hugh Grun Tanzey, Kansas City, Mo.

THE intention of this clinic is to call attention to some types of malocclusion presenting conditions favorable to the extraction of permanent molars or premolars, with the idea of closing the spaces caused by the loss of those teeth. Naturally one would assume that this treatment would merit consideration in the closing of spaces caused by previous loss of or congenital absence of teeth. We take refuge behind the inadvertent tendency of the human being to err, with no claim of originality or of infallibility, but we do invite constructive criticism. If we are not "off the track," there is a great field for investigation here.

Fig. 1.—Case 1, patient ten years old, bilateral distoclusion, mutilated by loss of mandibular right and left first permanent molars.

Case 1.—Fig. 1 represents a girl of ten years, presenting a pronounced type of bilateral distoclusion, complicated by a very narrow maxillary arch, the bunching of those teeth and mutilated by the loss of the mandibular right and left first molars. We feel justified in recommending the extraction of maxillary right and left first permanent molars with the idea of shifting all anterior teeth back and of moving the second molars forward, closing the spaces. The treatment of the mandibular teeth, (where right and left first permanent molars had been previously lost) will be much after the same fashion, comprehending the necessity of tipping the mesial cusps of second molars upward as those teeth are moved forward to close spaces. Our appliances provide for closing the bite and expanding the maxillary arch.

Case 2.—Fig. 3, child thirteen years old, with mutilated bilateral distoclusion complicated by the loss of the mandibular right and left first permanent molars, and by the pronounced narrowing of the arches. We also find an extreme lingual position of the maxillary right lateral, with apparent

*Read at the Twenty-eighth annual meeting of the American Society of Orthodontists, Estes Park, Colorado, July 18, 1929.

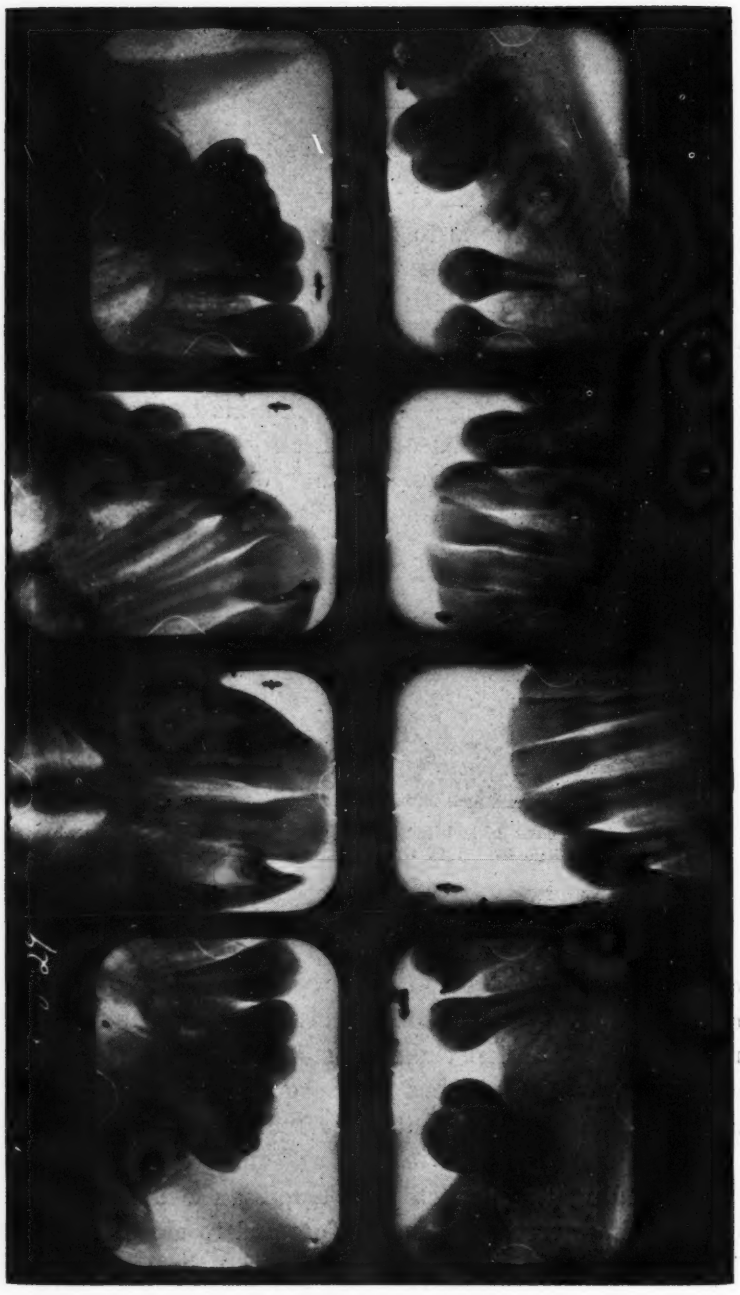


Fig. 2.—Case 1, patient ten years old, bilateral distoclusion, mutilated by loss of mandibular right (note root fragment) and left first permanent molars. Third molars in position.

labial position of all the canines. There is a deep overbite and a forward lunge of the mandibular right and left second permanent molars. Radiograms show that all the third molars are present.

Fig. 4 shows results obtained after three years and three months' treatment. The arch relationship is corrected and spaces are closed.

The radiograms in Fig. 5 show the third molars erupting in the position formerly occupied by the second molars. The maxillary first molars were extracted at our suggestion when treatment, which covered a period of thirty-nine months, was started. Both mandibular first molars had been lost several years previously as a result of extensive caries.

CASE 3.—A young man, eighteen years old, presented a bilateral mesioclusion case, mutilated by the previous loss of the maxillary right central (space being bridged) and left first molar (space closed by drifting teeth). Further complications included open-bite, a lingual position of the left maxil-

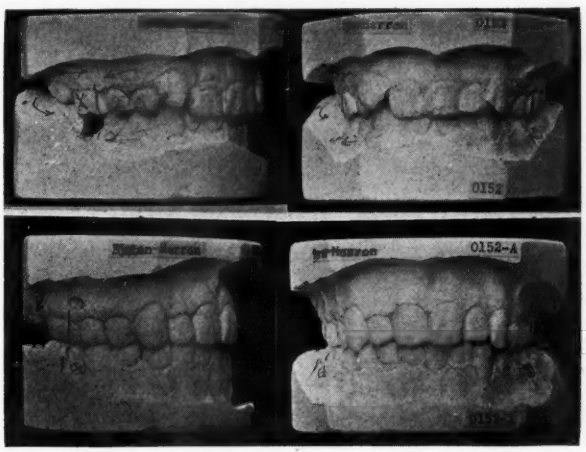


Fig. 3.

Fig. 4.

Fig. 3.—Case 2, patient thirteen years old, bilateral distoclusion, mutilated.
Fig. 4.—Case 2, patient sixteen years old.

lary teeth, an unbecoming anterior bridge supporting a too narrow restoration, an unerupted right fourth molar and a nonvital mandibular right first molar.

The preliminary treatment provided for the extraction of the maxillary right third and fourth molars (also a root fragment of left first molar), the severance of the anterior bridge, and the extraction of the mandibular right and left first molars.

The subsequent treatment outlined provided for the expansion of both arches, Fig. 10. The maxillary arch was expanded to accommodate a wider right central and to correct the cusp relation on the left side, and the mandibular arch was changed to allow adjustment of the anterior teeth. A duplicate temporary restoration is shown in Fig. 10 above and the original treatment appliance below. The latter consists of second molar pinch bands, with buccal tubes (20 G. inside diameter) and lingual bars 21 G. extending to the mesial surface of the second premolars; these teeth were banded with short buccal tubes and lingual U-clasp or spur attachments. The bands on the

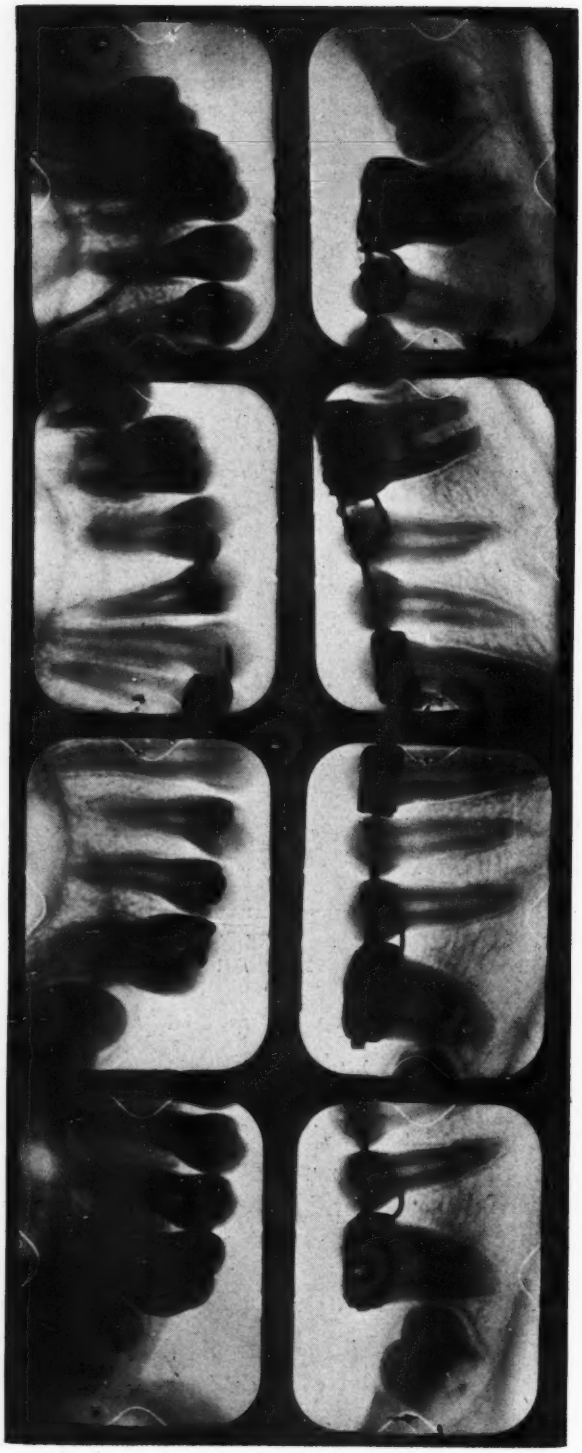


Fig. 5.—Case 2, patient sixteen years old.

right and left canines were pinched on the lingual sides with labial T-shaped brackets (something after the fashion of those proposed by Ketcham, I believe).

A 21 G. platinum and palladium labial arch, hammered flat in the anterior section with 22 G. loop spring stops of the same material, attached in a position to engage the mesial ends of the buccal tubes on the second premolars, was used as shown. Other accessories to this appliance include re-

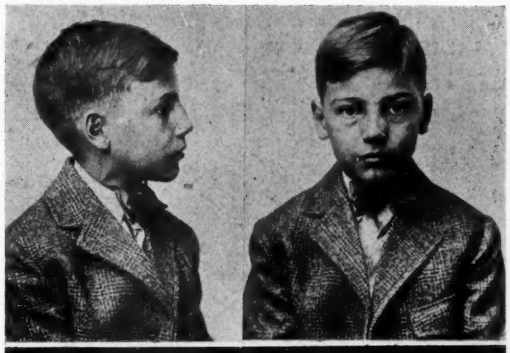


Fig. 6.

Fig. 7.

Fig. 6.—Case 2, patient thirteen years old, bilateral distoclusion, mutilated.
Fig. 7.—Case 2, patient sixteen years old. After thirty-nine months of treatment.

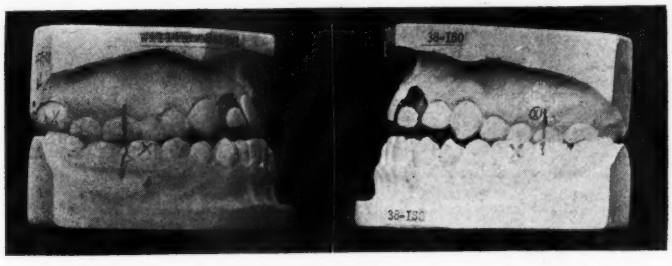


Fig. 8.—Case 3, patient eighteen years old.

traction hooks placed just distally to the canine region, spurs placed mesially to the canines to engage the intermaxillary elastics used in closing the bite; and lugs to engage the distal side of the brackets on the canine bands. (These were not placed until after sufficient expansion was effected to allow rotation of the canines and incisors.) While the intention was to move the second molars to the mesial surface and to obtain considerable lateral expansion, we hoped there would be some definite distal movement of all teeth forward of the first molars.

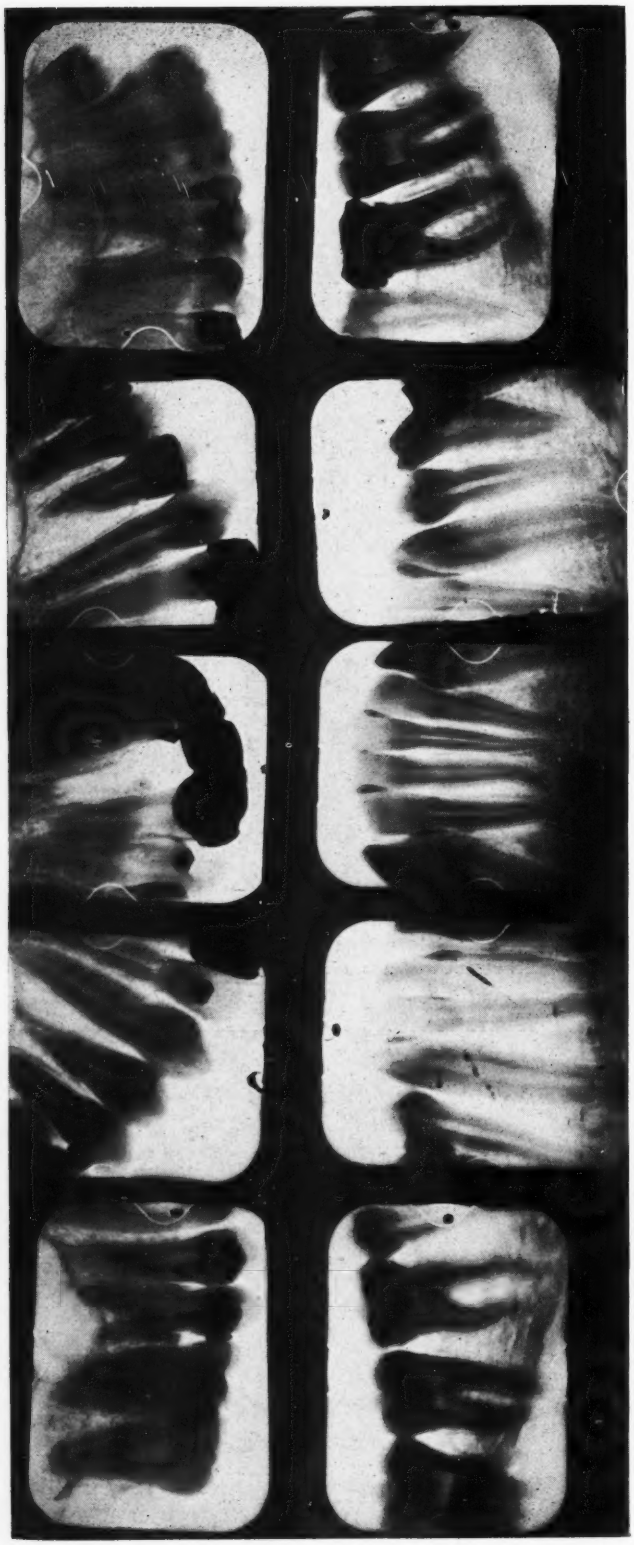


Fig. 9.—Case 3, patient eighteen years old. Bilateral mesioclusion mutilated by loss of maxillary right central and left first molar (note root fragment), further complicated by maxillary right fourth molar, and nonvital mandibular right first molar.

Tubes on the buccal side of the second molars and the second premolar bands were soldered as nearly as possible at right angles with the long axis of the tooth and in a position that would indicate that the individual tooth was in normal relation to the line of occlusion. (In cases where there is considerable tipping and rotation of the teeth on either side of the gap caused by the lost tooth, we recommend using a smaller gauge plain alignment wire, probably 23 or 24 G. to start with.)

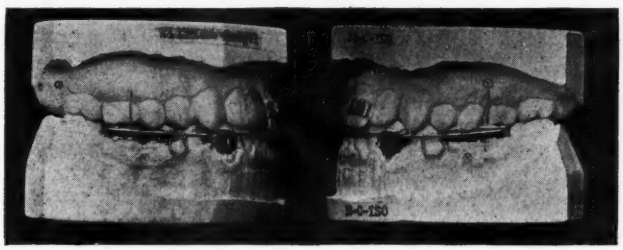


Fig. 10.—Case 3, patient twenty-one years old, maxillary right third and fourth molars and mandibular right and left first molars extracted. After thirty-one months of treatment.

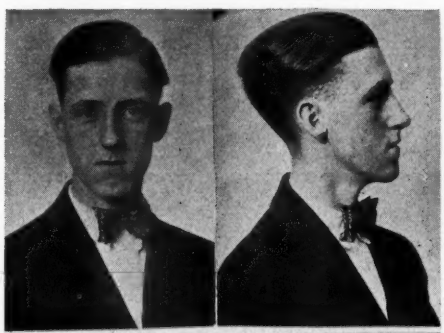


Fig. 11.

Fig. 12.

Fig. 11.—Case 3, patient eighteen years old. Bilateral mesioclusion, mutilated and complicated.
Fig. 12.—Case 3, patient twenty-one years old. After thirty-one months of treatment.

We like to start as many corrective movements simultaneously as appear at all feasible. As the molars and premolars are rotated and straightened, they are moved together, the tubes sliding along the alignment wire, using all the available resistance provided by the anterior teeth as anchorage, much of it being reciprocal. Grass line (extra small) and wire ligatures, also small, are used interchangeably, engaging the mesial hook ends of the lingual bars (the latter often used as a lever to assist in tilting and rotating the molars), extending forward usually around the canine teeth and the labial arch. Ligatures may also be used engaging the buccal tubes on the molar bands or small

hooks provided near the mesiobuccal angle, the ligature extending forward to engage the retraction hook on the labial arch or any lug, spur on band or resistance otherwise provided.

Fig. 13.

Fig. 14.

Fig. 13.—Case 4, patient nine years old. Bilateral distoclusion, narrow arches, prolonged retention of deciduous laterals.

Fig. 14.—Case 4, patient fifteen years old. After six years of intermittent treatment showing definite relapse of both arches.

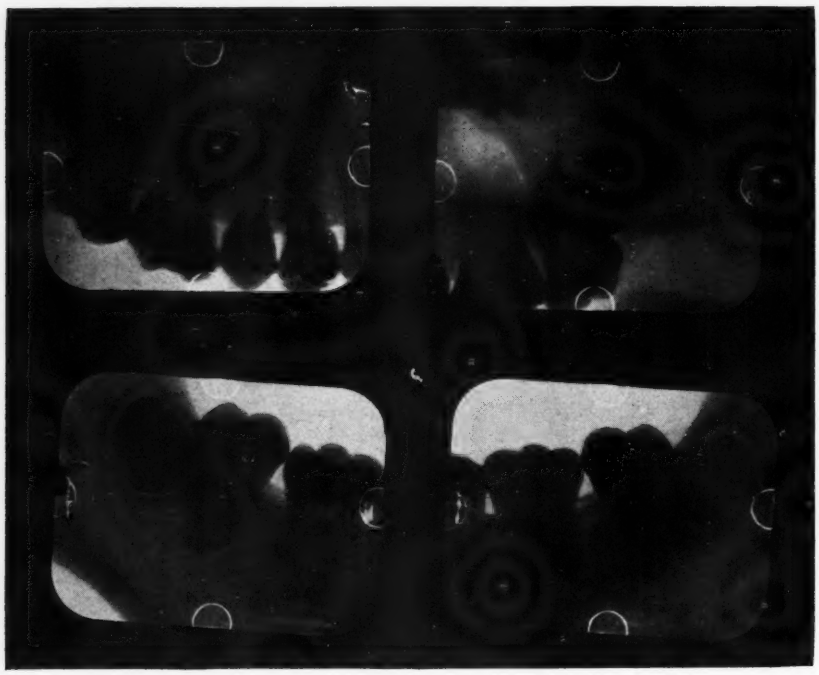


Fig. 15.—Case 4, patient fifteen years old. Radiograms show abnormally large impacted third molars.

In order to prevent buckling in the tube we believe that it is best to provide stress forward on both the lingual and the buccal aspects of the molar teeth.

CASE 4.—Patient, nine years old (Fig. 13), after nearly six years of intermittent treatment and rest periods (from 1918, the beginning, to 1922 she was under the care of another orthodontist), the teeth still in unsatisfactory alignment, we decided to extract the maxillary right and left first and the mandibular right and left second molars (Fig. 14).

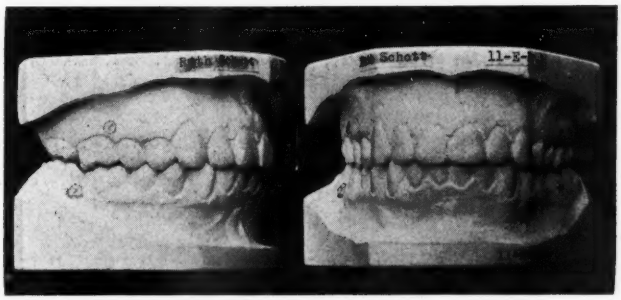


Fig. 16.—Case 4, patient sixteen and one-half years old. After twenty months including post-operative treatment the case was dismissed.

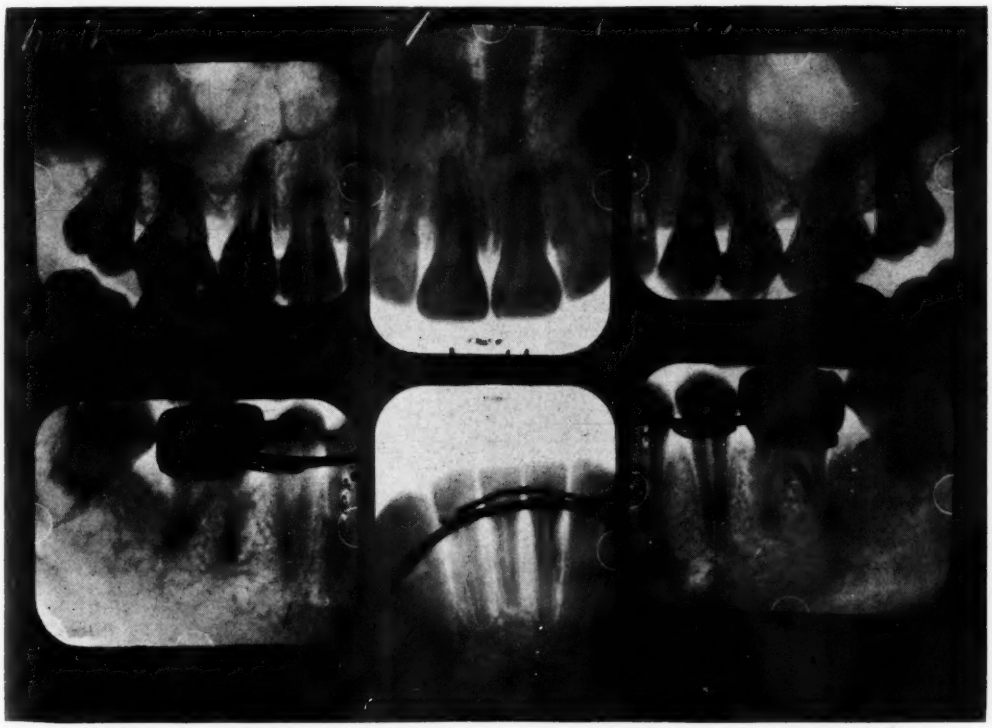


Fig. 17.—Case 4, patient sixteen years old. Radiogram shows relation of third molars at close of treatment.

The maxillary first molars were condemned because we thought we could more advantageously move other maxillary teeth back, and the mandibular second molars were sacrificed because of the unusually large unerupted third molars (Fig. 15).

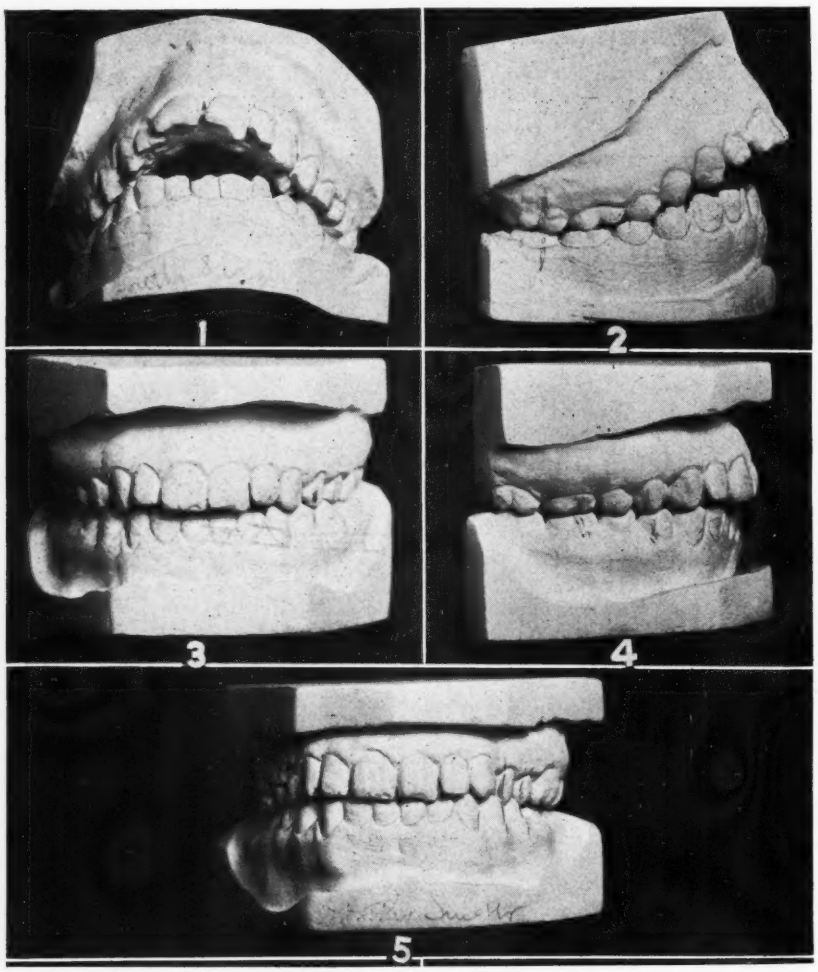
We were approximately twelve months moving the maxillary second molars forward and adjusting all other teeth to a satisfactory alignment, after which they were maintained in this position eight months.

# AN APPLIANCE FOR THE TREATMENT OF AN EXTREME OPEN-BITE CASE WITH LABIOVERSION OF THE MAXILLARY ANTERIOR TEETH*

By Elizabeth E. Richardson, D.D.S., San Francisco, Calif.

THIS case was treated with the labial expansion arch in the usual way, but did not respond to treatment in a reasonable length of time.

Figs. 1 and 2 show the case before treatment. Figs. 3 and 4 show the




progress of the case. Figs. 5 and 6 show the case at a later date but not completed. Figs. 7 and 8 show the appliance used.

*Treatment.*—Molar bands with buccal tubes and partial lingual wires were placed on the maxillary first permanent molars. A labial arch was used to ex-

*Read at a meeting of the Southwestern Society of Orthodontists at Kansas City, Mo., April 27, 1928.

pand in the molar and premolar regions. A like treatment was used for developing the mandibular arch.

Bands were then placed on the anterior teeth of the maxillary arch with half-open tubes of small size, soldered to the bands. A high labial arch of 18 gauge Everspring wire was fitted to conform to the shape of the maxillary arch, with a right angle bend in the region of the tubes on the molar bands to be used in place of the nuts, which prevents the arch from being forced through the tubes, under pressure. A piece of 18 gauge wire was then soldered to the arch from the right angle bend to a point in the canine region, to prevent the arch from being forced gingivally, which would cause irritation to the soft tissue. (This latter attachment is most necessary in controlling the spring force of the arch.) Wires of 0.022 gauge were soldered to the arch and bent as shown in Fig. 8. To obtain an incisal and lingual force,

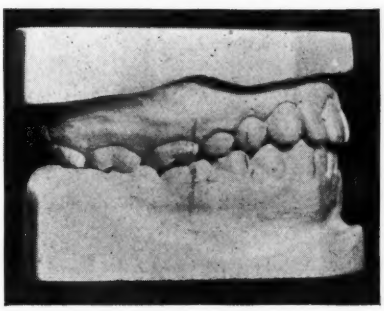


Fig. 6.

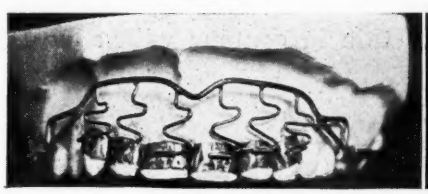


Fig. 7.

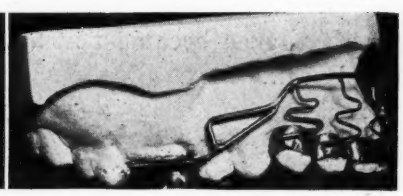


Fig. 8.

these wires were adjusted to fit into the half-open tubes on the bands on the anterior teeth that are in infraclusion.

The appliances shown in Figs. 7 and 8 are duplicates of the appliances used in the correction of this open-bite case, and fitted to models of a different case.

Under the above-described treatment this case responded to treatment in a reasonable length of time with no apparent discomfort to the patient.

The patient was about fourteen years of age. The malocclusion was caused by the use of a pacifier and by the finger habit.

This appliance may be used for the treatment of teeth in supraclusion by reversing the half-open tubes and engaging the 0.022 wires that are soldered to the arch, whereby an upward force may be obtained.

In the event of the molars tipping under this treatment, intermaxillary anchorage would be indicated.

## REPORT OF TWO CASES*

By Dr. A. C. Hamm, Denver, Colo.

Case 1.—A boy of sixteen years had been under the care of an orthodontist. The teeth were in normal occlusion. The cemento-enamel junctions of the teeth were rough, the enamel surfaces likewise were rough, and the gingival tissues were hyperemic and of an abnormal color. The cemento-enamel junctions were carefully planed and polished, and the uneven surfaces of the enamel were dressed down with discs and fine stones. Following the treatments the teeth presented a lustrous appearance, and the gingival tissues became normal in color and in tone.

Case 2.—A boy of seventeen years had teeth in malocclusion. Treatment for regulation had not been instituted. The cemento-enamel junctions of the teeth in this case were extremely rough and the gingival tissues were hypertrophied and cyanotic in color. The case was treated in the following manner: the cemento-enamel junctions, as in Case 1, were carefully planed, the enamel was polished and a labial portion of the thickened gum tissue in the incisal and cuspid regions was surgically removed. This operation was practiced in order to facilitate the return of the tissues to normalcy as the hypertrophied tissue was dense in texture. Following the tooth and gum operations the soft tissues became normally thin in contour with a healthy color tone of coral pink.

*Read at the twenty-eighth annual meeting of the American Society of Orthodontists, Estes Park, Colo., July 16-19, 1929.

# *DEPARTMENT OF*
# *ORAL SURGERY, ORAL PATHOLOGY AND SURGICAL ORTHODONTIA*



## INCIDENCE OF IMPACTED TEETH

By Sterling V. Mead, B.S., D.D.S., M.S., Washington, D. C.
*Director Research Department, Georgetown University Dental School*

THE study of the incidence of impacted teeth is very closely related to the study of the etiology of impacted teeth. There are one or two very dependable theories regarding the etiology of teeth, namely, the evolutionary changes and the changes due to lack of function of the teeth.

In a consideration of the etiology of impacted teeth, it is first necessary to exclude all those cases of rickets and all pathologic conditions which in any way might account for abnormality of the teeth and for delayed eruption. After this group is excluded, impacted teeth may probably be accounted for best by recognizing the forces of evolution and the actual mechanical features of the growth and eruption of the teeth. These two are the main causes of delayed eruption, and it is delay in eruption which is responsible for impaction, because it is usually observed that where teeth erupt normally, as they should at the proper time, they usually find proper accommodation in the jaw. It is important to remember that the jaw accommodates itself to and is changed in shape by, the teeth, and not vice versa.

The research department of the Georgetown University Dental School has made a study during the past year of 6,389 cases with a view to determining the incidence of impacted teeth. The study was made not only of present-day cases but of our present cases as compared with the mouths of people of different ages. In this study we were fortunate to have the cooperation and help of Dr. Hrdlička of the Smithsonian Institution with ten thousand skulls at our disposal. We were privileged to examine these skulls individually and x-ray them, and the study has been most interesting.

The fact that impactions are most frequently seen in white people gives weight to the argument that delayed eruption is largely responsible for impactions and that evolution, or in this case, involution, is responsible for tardy

eruption because of the advanced disuse of the teeth encountered in the more highly civilized races.

In a recent study of dental conditions among the Eskimos by Dr. Wahl for the Public Health Service, it has been shown that in all of the older generation caries, malocclusions, and impactions were rare, and that the diet of these people consisted of a hard diet requiring mastication. It was found that in the younger generation where their diet consists of, or is interfered with by the use of, carbohydrates, candies, etc., where there has been considerable disuse of the teeth, caries has become apparent as well as have malocclusions and impactions. It would seem that the disuse of teeth on any soft diet, or lack of function, would have a tendency to prevent normal eruption.

There is a marked similarity in dentition in all mammals, no matter how different the animal in general structure and mode of life. Each tooth has a strict homologue in all species, and in those cases in which fewer than the typical number of teeth are present (as in all existing mammals except the genera Sus, Gymnura, Talpa and Myogale) the teeth that are missing can be accurately defined. In the scale of mammalian life, man, ideally should have forty-four teeth. There are, however, only a few existing species of animals that have the ideal number of teeth, which are best exemplified by two fossil forms. A generalized formula has been devised to represent the perfect arrangement of teeth:

| i—incisor | c—canine | p—premolar | m—molar |
|---|---|---|---|
| i1, i2, i3 | c1 | p1, p2, p3, p4 | m1, m2, m3 |

This figure is duplicated to represent the eleven teeth appearing both above and below in both sides. The first of the incisors to be lost was the third, then the second; with the premolars it was the first, then the second, but with the molars, the order was the third first. Dr. Stiles states that when you have to consider supernumerary teeth, the excess tooth is defined by its position in the jaw as either a second incisor or a second premolar, as theoretically it is not possible for humans to have a supernumerary molar, as long as we have our perfect allotment of three molars.

There has been some suggestion on the part of anthropologists of the significance of the evolution of the skull with regard to function as relating to the teeth. It has been pointed out that the European skull does not protect the enclosed brain from injury efficiently as does the African skull. The African skull is stronger and more rigid, and the superior rigidity and massiveness in the African are racial characteristics but are not anatomically so obvious as in the skulls of prehistoric and primitive races, such as Neanderthal man and Piltdown man in whom the massiveness of the cranium has impressed all observers. It would seem that the cranium, therefore, in the lower type of man has acted as the capsule of the brain and has taken part in the forming of the nasal and respiratory apparatus, the apparatus of mastification, and in providing extensive areas for attachment of the trunk muscles. The more the cranium has had to provide for the attachment of masticatory and neck muscles the less efficiently could it perform its function of cranial capsule and allow the smaller individual variations of

the brain to have their fullest and least restricted performance. In Neanderthal man the brain was not a great deal larger than in the average European, but it was encased in a huge, massive cranium that gave attachment to various masticatory muscles and also was encroached upon posteriorly by neck muscles far more widely than is the skull of any other race. It has been suggested that the hypothesis is plausible that the secret of the modern European type lies in the capsular function of the cranium having acquired in that type for the first time a definite supremacy over the accessory functions.

It is recognized that the masticatory apparatus of modern man is undergoing atrophic changes. This is reflected in the teeth, especially with regard to the mandible and the maxilla. There is evidence to support the argument that two fully erupted molars on each side in the maxilla and mandible will more nearly represent the normal individual of the future. The speculation has been suggested that it is the anterior teeth which seem to show least the tendency toward suppression, that is to say, those teeth which are actuated by the masseter muscle which is not directly connected with the cranium; whereas the teeth which do show the tendency to suppression are those associated in function with the temporal muscle which arises directly from the cranial wall. The cranium is said to be throwing off the remnants of its masticatory function, and the temporal molar group is consequently tending to disappear.

Malocclusion may possibly have a direct bearing upon the etiology of impacted teeth. In the study of the etiology of malocclusion it is necessary to consider the various theories which comprise most of the major problems of biology, such as hereditary variations, diet and use, endocrine disturbances, perverted breathing, early loss of deciduous teeth, late retention of deciduous teeth, thumb-sucking, chemical factors, postural influences, etc.

Usually each malocclusion results from at least two sets of factors, one of which is the physiologic and the other is the environmental. The etiology of malocclusions is further complicated by the wide range in the degree of its development in different children who have similar habits, identical rates of growth and apparently the same condition of health.

In order of frequency of impactions in white people, we have the third molar and then the canine. It is interesting to note that these are the teeth that are evolutionally weakened and that the weakening process is evident in that same order. We might assume, therefore, that those teeth which are weakened through evolutionary processes are the ones that are late in erupting and are, therefore, the ones which are most liable to be impacted, because of the purely mechanical factors of bone growth and jaw formation.

In determining the incidence of impactions in the present day as compared with other races of the past it must be taken into consideration that the 1,462 office cases studied of the white race all came for dental treatment, and possibly there would be more chance of impaction in these cases. The museum cases came from unknown sources, as far as a complaint was concerned.

TABLE I

| RACE | NO. OF EXAMINATIONS | NUMBER | | NO. OF IMPACTIONS | NO. OF CASES | POSITION | | | | | | | | MISCELLANEOUS TEETH |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | MANDIB. | MAXIL. | | | MANDIBULAR THIRD | | MAXILLARY THIRD | | MAXILLARY CANINE | | MANDIBULAR CANINE | | |
| | | | | | | L | R | L | R | L | R | L | R | |
| Office Cases | 1462 | 1462 | 1462 | 518 | 276 | 122 | 126 | 105 | 108 | 11 | 12 | 1 | 1 | 32 |
| White (Smithsonian) | 966 | 888 | 350 | 55 | 35 | 19 | 26 | 5 | 5 | – | – | – | – | – |
| Eskimo (Smithsonian) | 1347 | 1187 | 585 | 74 | 41 | 24 | 24 | 13 | 13 | – | – | – | – | – |
| Peruvian (Smithsonian) | 1771 | 481 | 1345 | 215 | 120 | 29 | 28 | 78 | 80 | – | – | – | – | – |
| Indian (Smithsonian) | 386 | 230 | 301 | 37 | 19 | 8 | 6 | 12 | 11 | – | – | – | – | – |
| Mongolian (Smithsonian) | 117 | 37 | 117 | 10 | 7 | 2 | – | 5 | 3 | – | – | – | – | – |
| Negro (Smithsonian) | 155 | 117 | 83 | 6 | 3 | 2 | 2 | 1 | 1 | – | – | – | – | – |
| Egyptian 12th Dynasty (Smithsonian) | 115 | 6 | 115 | 9 | 5 | – | – | 4 | 5 | – | – | – | – | – |
| Hawaiian | 50 | 20 | 50 | 1 | 1 | 1 | – | – | – | – | – | – | – | – |
| Bohemian (Smithsonian) | 20 | 0 | 20 | – | – | – | – | – | – | – | – | – | – | – |
| | 6389 | 4428 | 4428 | 925 | 507 | 207 | 212 | 223 | 226 | 11 | 12 | 1 | 1 | 32 |

In our study of impacted teeth there were some 6,389 cases. Of these 1,462 were studies of full mouth roentgenograms of white people showing both the mandible and the maxilla. The balance, or 4,927, were made up of both mandibles and maxillae, and this study was made of skulls in the Smithsonian Institution. These mandibles and maxillae were studied carefully for missing teeth and for the appearance of impactions, and they were routinely x-rayed for impactions.

Table I shows the number of cases examined both in our office and in the Smithsonian Institution, namely, 6,389. It shows the number of impactions found (925), the number of cases in which impactions occur (507), as in many instances more than one impaction was found in the same mouth. It also shows the number of impacted mandibular and maxillary third molars and canines. The supernumerary teeth—central incisors, lateral incisors, first premolars, second premolars and first and second molars—were grouped under "miscellaneous," as these did not occur frequently during our examination.

Table II shows the number of different impactions with regard to their kind and anatomic position and the percentage of their incidence in a study of 1,462 office cases. It shows the total number of impactions in the mandible

TABLE II

NUMBER OF IMPACTED TEETH IN 1462 OFFICE CASES

| | MAXILLARY AND MANDIBULAR | | MANDIBULAR | | MAXILLARY | |
|---|---|---|---|---|---|---|
| | NO. | PER CENT | NO. | PER CENT | NO. | PER CENT |
| Supernumerary | 12 | 2.3 | 3 | 1.12 | 9 | 3.53 |
| Central Incisors | 5 | 0.96 | – | – | 5 | 1.96 |
| Lateral Incisors | 1 | 0.02 | – | – | 1 | 0.40 |
| Canines | 25 | 4.8 | 2 | 0.74 | 23 | 9.00 |
| First Premolars | 1 | 0.02 | 1 | 0.37 | – | – |
| Second Premolars | 11 | 2.1 | 9 | 3.39 | 2 | 0.80 |
| First Molars | – | – | – | – | – | – |
| Second Molars | 2 | 0.04 | 1 | 0.37 | 1 | 0.40 |
| Third Molars | 461 | 89.76 | 248 | 94.01 | 213 | 83.81 |
| Total | 518 | 100.0 | 264 | 100.0 | 254 | 100.0 |

TABLE III

| RACE | NUMBER OF MANDIBLES EXAMINED | NUMBER OF IMPACTIONS FOUND | PER CENT | NUMBER OF MAXILLAS EXAMINED | NUMBER OF IMPACTIONS FOUND | PER CENT |
|---|---|---|---|---|---|---|
| Office Cases | 1462 | 264 | 18.05 | 1462 | 254 | 17.3 |
| White (Smithsonian) | 888 | 45 | 4.68 | 350 | 10 | 2.85 |
| Eskimo (Smithsonian) | 1187 | 48 | 4.04 | 585 | 26 | 4.44 |
| Peruvian (Smithsonian) | 481 | 57 | 11.9 | 1345 | 158 | 11.75 |
| Indian (Smithsonian) | 230 | 14 | 6.09 | 301 | 23 | 7.64 |
| Mongolian (Smithsonian) | 37 | 2 | 5.4 | 117 | 8 | 6.84 |
| Negro (Smithsonian) | 117 | 4 | 3.42 | 83 | 2 | 2.41 |
| Egyptian 12th Dynasty (Smithsonian) | 6 | – | – | 115 | 9 | 7.82 |

and maxilla and the percentage. It also shows the number and the percentage of impactions individually in the mandible and the maxilla.

Table III shows the number of mandibles and the number of maxillae examined both in office cases and in the Smithsonian Institution cases, and this table also shows the percentage of these impactions.

---

## THE SEPTIC PHLEGMON OF THE FLOOR OF THE MOUTH BY GENSOUL*

By A. Vachey and M. Dechaume, France

*Translated by N. S. Brown. From the Surgical Service of V. P. Blair and J. B. Brown, Washington University School of Medicine, St. Louis, Mo.*

THE name of Gensoul calls to mind, with just cause, the resection of the superior maxilla, which he first performed, May 26, 1827.

Certainly, this is the finest surgical title of the aged surgeon-major of "l'Hotel-Dieu." But his writings in which he was often precursor must not be forgotten. Thus, in the *Journal Clinique des Hopitaux de Lyon* founded by him in 1830, with Dr. Dupasquier there is found a masterful description of the grave affection which even now we often call, incorrectly, Ludwig's angina.

Gensoul begins his descriptions by several etiologic considerations:

"The muscles of the sublingual and superior hyoid region," says he, "are exposed to inflammation separately, but this case seems rare, because of the contiguity of the cellular tissue at the time of the angina of the pharynx or of the phlegmon of the superior part of the neck. The more modern authors have not made a particular description of this inflammation, which I know necessitates a special treatment for the cure. However, I have had occasion to observe it three times: once constituted by an isolated affection analogous to the glossitis, and twice by contiguity.

"I attribute this malady which I have seen only at Lyon to the low temperature and humidity of the climate in the city, to its narrow streets, to the great height of its houses which hold an almost continual humidity there, and above all to the few hygienic precautions of its inhabitants."

The clinical description is written in a complete and precise manner and deserves to be reported fully.

"The difficulty I have seen with this infection is that the patients try to drop the jaw and move the tongue although it is impossible to carry through the movement of deglutition. A circular tumor which seems to form a second chin, in its appearance, extends to the hyoid bone; a sensation of very strong resistance is proved by placing the ball of the finger on the mortified surface. This muscular inflammation is distinguished from phlegmon by the following characteristics:

*From Lyon chir., 24: 642, 1927.

"1. The neck never acquires such size as it does in this malady.

"2. The skin participates very little in the inflammation of the muscles. It reddens and may become brilliant in phlegmon.

"3. It does not form, as in phlegmon, purulent sources or spontaneous openings which originate in fragments of mortified cellular tissue.

"The sharp inflammatory congestion of the submaxillary glands is not to be confused with this malady because it is always very easy to distinguish the organs under the skin, even though they are not augmented in size."

Gensoul also remarks on the rapidly dangerous evolution of this infection.

"The first two patients were brought into the hospital breathing with difficulty, unable to perform any movement of deglutition and presenting a tough, circular tumor beneath the chin. Seeing them in this state I could not help reproaching them on their negligence, but I was surprised to find that these patients had been in pain but forty-eight hours, and only a few days before they had shown only a slight difficulty in swallowing.

"Besides," he adds, "the patient has been in grave danger during the space of thirty-six to forty-eight hours." This is shown by the respiration becoming laborious, the face bluish, inability to expel the mucus, which congests the bronchial tubes, the neck edematous, and at last the patient falls prey to delirium just before the end.

In the following account of the autopsy of one of his patients he mentions the characteristic lesions:

"The neck was blackish, swollen and enormously distended by flatus. I made an incision in the skin, of which the opening gave issue to fetid gases. The cellular tissue seemed sound and only distended. When I wished to make an incision in the muscles, I found them partly gangrenous and partly softened in the center, so that they resembled grayish boiled beef. The mucous membrane of the throat was red and presented at several points traces of a lively inflammation, but no trace of slough, as in the gangrenous angina. The tongue seemed slightly swollen, and the trachea was filled with mucus but offered a normal aspect." The autopsy showed no other attending lesions.

As to the treatment, after having studied in divers cases "the insufficiency of ordinary antiphlogiston means," Gensoul conceived the surgical treatment which he practiced on his next patient, observing: "I could not endure being a tranquil spectator of the death of a man in the prime of life, therefore I resolved to apply to this malady the curative treatment of the glossitis, that is to say, to make deep scarifications. I plunged the knife through the median line of the neck, from the symphysis of the hyoid bone to the chin, sinking it deeply at the base of the tongue. At once, blood flowed, the lips of the wound turned back, in a word, the patient seemed to show a condition of well-being.

"Under the influence of this treatment, improvement becomes more sensational, the functions of the muscles reestablish themselves little by little, to such a point that at the end of eight days recovery is almost complete. The wound that I had made had diminished in extent and depth and began

to heal rapidly. (I ought to say here that this wound suppurated very little and reunited itself, as they say, by second intention.)''

Thus, in 1830, Gensoul gives the first complete description of this affection, until then unrecognized. Six years later, in 1836, Ludwig, professor of surgery at Stuttgart, published an account on the gangrenous induration of the neck; he simply states that in this malady two factors must be considered: the erysipelatous nature and the particular nervous state of the subject. ''By his erysipelatous factor, the patient favors the disposition to a gangrenous inflammation, as in the malignant furuncle, while, by his nervous factor, he predisposes to the induration and to the paralysis, as in the malignant parotitis.'' The fame obtained by this memoir makes certain cases that Ludwig had interesting to observe. Some high personages were treated by him and in particular, Queen Catherine of Württemberg who, it seems, died with this affection.

In 1836 also Schmetzer and Theurer report some analogous observations.

In 1837, Camerer, in an article entitled, ''Sublingual Cynanche'' (Württemberg Corr-Blatt), exposes a double error in calling this affection by the name of Ludwig's angina, and in calling angina an affection of which the anatomic regions, as he had often noted with Gensoul, do not localize principally at the level of the tonsils.

In following years numerous articles were written on the so-called ''Ludwig's angina'' by authors who tried to specify the characteristics of it. (Heyfelder, 1828; Bermann, Timpe, 1840; Zillner, 1845; Blasberg, 1846; Cnopf, 1849; Spenlger, 1851; von Thaden, 1872; Murchison, 1875; Gilette, Tillaux, 1877.)

Roser, 1883, attributes it to a primary inflammation of the submaxillary gland and of its cellular surrounding, epidemic, and provoked by an infectious agent of undetermined nature.

Boehler, 1885, declares that ''Ludwig's angina'' is not a special entity of infectious nature, but distinguishes itself by its clinical and anatomic characters, from other inflammatory processes of the region of the neck. According to him, the question is in all these cases one of simple secondary gangrenous phlegmons in which the origin can always be found in the neighboring regions. ''The name 'Ludwig's angina' ought to be rejected because it implies an idea of essentiality; it is superfluous, because it was attributed to some cases which occurred unquestioned in the classified lists of pathology.''

Tissier, 1886, in the ''Progres Medical,'' devotes a long study to the angina named for Ludwig, which he prefers to call submaxillary angina.

It seems that the preceding authors had not known of or had wished to ignore Gensoul's description. Those which they gave had nothing new and only lent more confusion to the study of this infection.

Daniel Molliere, chief surgeon of l'Hotel-Dieu de Lyon in 1888, in one of his surgical lectures in the clinic reviews the study of this infection, which he calls ''subhyoid septic phlegmon.'' He reports three observations and shows that the particular aspect of the subhyoid phlegmon had not escaped his illustrious predecessor, Gensoul. He gives an integral report of his clini-

cal and bacteriologic research. "I charged my chief of biology to make cultures taken from the phlegmon of our patient at Saint Paul's. But the multiplicity of the pathogenic microbes with which he met would not permit us to formulate scientific conclusions. In any case, the septic vibrion is the cause."

For the rest, the name of Ludwig's angina still persists. Thus Letterier, in 1893, in his thesis on the sublingual phlegmon said, "Ludwig's angina speaks uniquely of this author" to whom he gives the entire credit for having discovered this infection.

However, in 1897, Lyon, in his thesis (Monpelier), "Contribution to the study of infectious subhyoid and sublingual phlegmon" speaks of the angina of Gensoul-Ludwig and establishes the truth of it.

So, in 1898, in the treatment of Le Dentu and Delbet, Morestin writes: "Of this complex history it results, in the end, that the term Ludwig's angina is doubly wrong, because it does not concern the angina, and because the affection which it does concern was described before Ludwig."

In 1921-22, Richard, in his thesis "Contribution to the study of gangrenous phlegmon of the floor of the mouth," recalls Gensoul, historically, the first to describe the muscular angina in such terms.

However, the term Ludwig's angina is found in recent publications of Dufourmental and Frisone (1918), and of Peyre (1920). In classic treatises it is often given the preference. Without question, however, it should be erased from all surgical literature. The fact that it is consecrated by usage is not sufficient motive to keep it. As Morestin and Reclus have so aptly put it, "The denomination of Ludwig's angina is false, radically and doubly false, because Ludwig's angina does not develop on a level with the throat, and because a Frenchman, Gensoul, described this infection in 1830, six years before Ludwig."

Gensoul, in fact, has given for those lesions an anatomic and clinical description which remains intact; he has stated the principle of the surgical treatment. The chief surgeon at l'Hotel-Dieu de Lyon deserves the entire credit for having isolated and individualized this infection which his successor, Daniel Molliere, named "septic subhyoid phlegmon." And it will only be justice to use for all time the term septic phlegmon of Gensoul instead of Ludwig's angina.

# *ABSTRACT OF*
# *CURRENT LITERATURE*

NUTRITION AND PEDIATRICS

By Samuel Adams Cohen, M.D., New Yerk City

It is the purpose of this Journal to review so far as possible the most important literature as it appears in English and Foreign periodicals and to present it in abstract form. Authors are requested to send abstracts or reprints of their papers to the publishers.

## Nutrition and Pediatrics

**Problems in Filipino Nutrition.** F. O. Santos. J. Philippine Islands M. A. 10: 3, 1930.

Santos discusses some of the interesting data pertaining to what he terms Filipino nutrition. He quotes Aron and Hoesin, who found that it was not possible to establish nitrogen equilibrium with the simple Filipino diet of rice, bread, fish, sugar and coffee, even in cases where the protein intake was comparatively high (53 to 62 grams of protein), if the total caloric intake was less than 1800 calories per 110 pounds of body weight. In regard to the intake of fat by the population at large, he states that there seems to be a direct relation between the intake of fat and the financial status of the people. Since rice is the principal food material, it is obvious that the Filipino ingests enough, if not too much, of carbohydrate food.

Because of the scanty amount of definite knowledge regarding the nutritional requirements of the Filipinos, Santos makes a plea for a more extensive study and an educational campaign to stimulate further interest in this all important subject. For example, the incidence of beriberi could be materially reduced if the inhabitants, both rich and poor, could be induced to eat foods containing vitamins, in addition to their food habit of eating large quantities of polished rice. In regard to the fact that the Filipinos are much smaller than Europeans and Americans, Santos cites some strong points against the factor of heredity when he quotes Alberto Tupas, who recently (1929) reported the favorable effect of improved food on the growth of children. On this same point McCollum and Simmonds reported in 1925 that Japanese children born and reared in America are larger at all ages than are Japanese children born and reared in Japan. This advantage in physical development is attributed by them to the superior food in this country. These same experts also reported that although when the nutrition of their experimental rats "fell just below a certain standard" there were no observable signs of malnutrition, nevertheless, the size of these animals diminished from generation to generation. Perhaps these interesting animal observations might include the answer for the traditional smaller stature of the Filipinos.

**The Importance of Body Type and Constitution in Infancy and Childhood.** Borden Veeder. J. Michigan M. Soc. **29**: 6, 1930.

While the number of pathologic conditions and structural abnormalities which are definitely hereditary in origin are relatively few and unimportant, nevertheless, according to Veeder, heredity is almost the exclusive factor in determining the physical makings of the individual.

In his own experience, the writer classifies normal infants into three groups: (1) the mean, or average group; (2) the hypertonic, and (3) the hypotonic. The hypertonic group is, as a rule, below the average weight figures for infants of the same age, with clear fine skin and sparse subcutaneous tissue. Their striking characteristic is their activity, and, consequently, they possess good muscular development. As a rule they sleep less; their behavior is of a temperamental nature, they voice their likes and dislikes in a decided way. Usually, at least one of the parents of the hypertonic child is of slender build, but muscular and active.

The hypotonic infant is weak and flabby with coarse skin. His weight and height is about the average, and he is calm, placid and slow in movement and response.

Between these two groups is the average tonus group, which may be above or below the average weight for age figures.

In childhood, particularly, are the different types of body habitus more pronounced, and Veeder states that the differences are due to inherited factors. The fact that the chest measurement of one child is several inches less than that of the other, or that one child is slender, wiry or muscular, and the other stocky with a tendency toward adiposity is of insignificant moment in determining whether such a child is labeled malnourished because its measurements happen to fall below the average for its age group.

Veeder further emphasizes that which has been frequently stated by other physicians, namely, that the diagnosis of malnutrition must be based upon the physical examination of the total child, and not upon weight.

**The Nature of Obesity.** L. H. Newburgh and Margaret Woodwell Johnston. J. Clin. Investigation **8**: 2, 1930.

The authors state that obesity is never directly caused by abnormal metabolism, but that it is always due to food habits not adjusted to the metabolic requirements—either the ingestion of more food than is normally needed, or the failure to reduce the intake of food in response to a lowered basal requirement. Continuing along the same line of thought, these writers hold that obese persons may be divided into two groups: the first and larger group acquire the state of obesity because they overeat, either knowingly, or because their mechanism is such that they, either by habit or otherwise, require stimuli of greater intensity before they feel that they have eaten a sufficient amount to satisfy them. In the second group are persons who, although they eat what is for them a normal amount, have reduced their expenditure of energy. This reduction in the expenditure of energy occurs either (1) because of advancing years, change of occupation, etc., or (2) their

basal rate becomes abnormally low as a result of myxedema or other diseases of the endocrine glands.

However, these authorities, who write from the University of Michigan, further state that in the second group adiposity does not invariably develop.

**The Metabolism of Obesity and Mechanical Efficiency.** Chiche Wang, Solomon Strouse and Zelma O. Morton. Arch. Int. Med. **45**: 5, 1930.

These Chicago investigators continue to report upon their excellent work on obesity. In this communication they report their fifty-seven experiments on twenty-seven obese, nine normal and seven underweight subjects, the youngest of whom was sixteen years old. They noted that the mechanism of efficiency varied inversely with the percentage of overweight. With the obese group they further noted that there was a gradual decrease in mechanical efficiency with an increase in obesity.

**Gastric Secretion in Infants and Children.** A. V. Neale. Arch. Dis. Child. **5**: 26, 1930.

Until recently accurate estimations of the gastric fluids of infants and children were practically impossible because of the psychical and physical disturbances which follow passing a gastric tube after a test meal. To offset these difficulties, Neale used a special tube with a small metal tip which was passed into the stomach by the nasal route. To assist him in securing a fairly accurate estimate of the volume and acidity of pure gastric secretion in infants and children, the writer made use of bestidine, which when injected subcutaneously has a specific effect in the stimulation of gastric secretion. In adults the curve of secretion is similar in all persons, there being a rapid rise in volume during thirty minutes immediately following histamine injection, and a continued fall thereafter until at sixty minutes the previous resting rate is retained.

Among Neale's conclusions are: (1) that the maximum acidity of pure gastric juice varies considerably in any one age group in infants and children; (2) that the volume of gastric secretion in infants during the milk period is very small; after this period the quantity is very greatly increased; (3) that it is suggested that the gastric secretion in the infant does not play so important a part in normal digestion as it does in the older child.

**The Use of Gelatin as a Supplementary Food in the Infant's Dietary.** T. O. Elterich, D. H. Boyd, and Andrew Neff. Arch. Pediat. **47**: 5, 1930.

The first scientific mention of gelatin as a foodstuff was in 1682 by Dionus Papin, who extracted gelatin from bones and fed soups prepared from the gelatin to the poor, and until 1831 there were many authoritative supporters and scientific bodies who believed that gelatin was the most nutritive part of animal food. About that time until 1838 further experiments with gelatin shattered the belief in its nutritive value. In 1841, however, a commission of the Paris Academy of Medicine reported that gelatin is not a

complete food, and later at a meeting at the Paris Academy of Medicine in 1850, it was announced that gelatin could not be considered a food factor in any sense.

It remained for Carl Voit in 1872 to class gelatin as a foodstuff, and since that time experimental work with gelatin has substantiated Voit in his claim that gelatin acts like protein matter.

Reporting from the Mellon Institute and also the University of Pittsburgh Medical School, these writers state that commercial gelatin is composed of approximately 86 per cent protein, 13 per cent water, and 1 per cent ash. Gelatin preparations which are put on the market primarily for dessert purposes are not pure gelatin products and contain as much as 85 per cent carbohydrate and only 12 per cent protein. These authors quote the work of McCollum, Simmonds and Pitz, who found gelatin a very efficient supplementary protein when fed with the protein of wheat and corn.

Because during the past fifty years various European and American authorities have reported from indifferent to excellent results with the use of gelatin as a food for children, and because very little work has been done with gelatin as an infant food, these investigators studied the clinical effects of gelatin feedings in eleven infants who were observed for a period of about three and one-half months.

Their summary in part includes the statement that large amounts of gelatin may be administered to very small infants over fairly long periods of time without any apparent unfavorable consequences. (As a rule these investigators gave these infants one ounce of gelatin daily.) One hundred calories of gelatin (4 level tablespoons) may be added to the day's formula without increasing the volume. As for its food value, they state that gelatin acts like protein matter, and gain in weight is in proportion to protein carbohydrate ratio.

# The International Journal of Orthodontia, Oral Surgery and Radiography

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 3523-25 Pine Blvd., St. Louis, Mo.

**Foreign Depots** — *Great Britain* — Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

**Subscription Rates**—Single copies, 75 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $7.00 per year in advance. Under foreign postage, $7.40. Volume begins with January and ends with December of each year.

**Remittances**—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter payable to the publishers, The C. V. Mosby Company.

**Contributions**—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this Journal.

**Opinions**—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

**Reprints**—The publishers will communicate with authors regarding reprints upon publication of paper.

**Communications**—Contributed articles, illustrations, letter, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 17 Park Ave., New York City. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 3523-25 Pine Blvd., St. Louis, Mo.

**Illustrations**—Such half-tones and zinc etchings as in the judgment of the editor are necessary to illustrate articles will be furnished when photographs or drawings are supplied by the authors of said articles.

**Advertisements** — Objectionable advertisements will not be accepted for publication in this Journal. Forms close first of month preceding date of issue. Advertising rates and sizes on application.

**Change of Address**—The publishers should be advised of change of subscriber's address about fifteen days before date of issue with both new and old addresses given.

**Nonreceipt of Copies**—Complaints for nonreceipts of copies or requests for extra numbers must be received on or before the fifteenth of the month of publication; otherwise the supply is apt to be exhausted.

Entered at the Post Office at St. Louis, Mo., as Second-Class Matter.


# *EDITORIALS*

## A Relapse or a New Case

IF ONE would take the trouble to go back through orthodontic literature, one would find many articles dealing with problems of retention, relapse of cases treated, and so-called failures. In years past these relapsed conditions were often attributed to faulty treatment and retention. In fact, older operators tried to formulate some fixed rule for retention. The statement was often made that the time for retention was to be twice that of treatment. It is our belief that this statement was based upon the mistaken idea that if teeth were held in a certain position for a sufficiently long time, they would eventually become firm and remain in that position.

By this plan of procedure, some cases were completed satisfactorily, the teeth remaining in an approximately normal occlusion. In other cases, regard-

less of how long the teeth were retained, they eventually returned to malposition. It is our opinion that these so-called relapses were not due to faulty treatment as such, or faulty retention, but in the majority of instances, were due to the failure to remove the original cause of the malocclusion. Because of this, I think it has been an error to refer to such cases as failures or relapses, when as a matter of fact another malocclusion has developed from the same or similar causes which produced the first.

Malocclusions are always produced by some positive etiologic factors and do not occur from normal growth and development. In other words, if the normal physiologic processes were not interfered with, malocclusion would never occur. It is, therefore, more important in treating malocclusion, to remove and eliminate the original cause than to depend upon a long period of retention to hold the teeth in the proper position.

For a number of years it has been our plan to eliminate retention as a definite phase in treatment. We find that where it seems necessary to use a retaining appliance, it may be considered, in the majority of cases, as evidence that the original cause of the malocclusion has not been removed. A type of case which particularly proves this to be true, is the case with abnormal breathing and abnormal muscular habits. It has long been our rule to inform the patients that unless mouth breathing can be corrected and normal muscular habits established, the teeth will return to malocclusion regardless of how well they have been treated or how long retained.

We know of a number of men who are basing their hopes on retaining appliances in cases that will eventually be classed as failures, unless the patients become normal breathers and assume normal lip habits. We contend that such a case referred to as a failure or a relapse is misleading because in reality it is not a relapse but another case of malocclusion produced by etiologic factors which have developed after previous treatment, or were never removed.

We hold, therefore, that any plan of treatment that does not remove the etiologic factor, will allow another case of malocclusion to develop and such a condition is a new deformity and not a relapse or a failure.

# NEWS AND NOTES

### Second International Orthodontic Congress

The Second International Orthodontic Congress will be held in London in 1931 at the Hotel Great Central from July 20 to 24 inclusive.

The officers of the Congress will be as follows:

| | |
|---|---|
| President-General | J. H. Badcock |
| Vice-President-General | G. Northcroft |
| Treasurer-General | E. D. Barrows |
| Secretaries-General | A. C. Lockett |
| | B. M. Stephens |

A list of honorary presidents and vice-presidents will be communicated later.

A full and interesting program of papers and demonstrations is anticipated, and a museum is being organized. Suitable entertainment for ladies accompanying members will be arranged. Intending contributors to the activities of the Congress can obtain from the Secretaries of their respective orthodontic (or dental) societies the conditions under which contributions are invited. The Secretary-General (Mr. A. C. Lockett, 75 Grosvenor Street, London, W. 1) will also be glad to give any further information on request.

Information regarding travelling facilities and hotel accommodation may be obtained from the official agents to the Congress, Messrs. Morgan Pope & Co., of 7 St. James's Street, London, S. W. 1; 6 Rue Caumartin, Paris; 71 Vanderbilt Avenue, New York; Messrs. Noel Vester & Co. (agents), 44 Unter den Linden, Berlin.

---

### Greater New York December Meeting for Better Dentistry

The sixth Greater New York December Meeting for Better Dentistry will be held at the Hotel Pennsylvania, New York City, December 1-5, 1930.

A return post card sent to the membership of both societies, including nineteen subjects which the Committee considered might be of interest to subscribers, brought over five hundred replies showing a marked interest in suggestions to the Committee for selection of clinic material.

The topic discussions will again occupy an important place in the program.

A manufacturers' exhibit will be held in the hotel simultaneously with this meeting.

JOHN T. HANKS, Chairman.
CHARLES M. MCNEELY, Vice-Chairman.

---

### Sixty-Seventh Annual Meeting and Clinic Chicago Dental Society

February 2, 3, 4, and 5, 1931

The Chicago Dental Society extends a cordial invitation to all members of the American Dental Association to attend its Annual Meeting and Clinic to be held at the Stevens Hotel, Chicago, February 2, 3, 4, and 5, 1931.

Following is a list of the Sections together with the names and addresses of the various section chairmen. It is their very earnest desire to prepare a program which will meet with

universal approval. To that end they solicit constructive criticisms and suggestions which will assist them in the selection of essayists and subjects to be presented and discussed. Other suggestions for the improvement of the meeting and the comfort of visitors should be directed to the Secretary.

*Section I.—Operative Dentistry:*
Chairman—A. E. Schneider, 25 E. Washington St.
Vice-Chairman—E. W. Swanson, 25 E. Washington St.
*Section II.—Full Dentures:*
Chairman—Robert R. Gillis, Hammond, Ind.
Vice Chairman—J. M. Besser, 55 E. Washington St.
*Section III.—Partial Dentures; Crown and Bridge:*
Chairman—R. A. Jentzsch, 185 N. Wabash Ave.
Vice-Chairman—O. W. Silberhorn, 180 N. Michigan Ave.
*Section IV.—Oral Pathology:*
Chairman—W. G. Skillen, 311 E. Chicago Ave.
Vice-Chairman—Isaac Schour, 1838 W. Harrison St.
*Section V.—Mouth Hygiene:*
Chairman—Irwin G. Jirka, 3165 W. Madison St.
Vice-Chairman—F. B. Rhobotham, 55 E. Washington St.
*Section VI.—Orthodontia:*
Chairman—F. B. Noyes, 30 N. Michigan Ave.
Vice-Chairman—F. E. Haberle, 55 E. Washington St.
*Section VII.—Oral Surgery:*
Chairman—E. L. Dunn, 25 E. Washington St.
Vice-Chairman—J. L. Meredith, 30 N. Michigan Ave.
*Section VIII.—Dental Economics:*
Chairman—John H. Cadmus, 185 N. Wabash Ave.
Vice-Chairman—F. van Minden, 185 N. Wabash Ave.

Dr. Stanley D. Tylman will again be the chairman of the Program Committee assisted by Drs. Frank H. Vorhees, David W. Adams, Frank G. Conklin, and M. M. Printz.

The extension of the meeting from a three- to a four-day meeting will give visitors an opportunity to attend more lectures and clinics than in past years. The large Exhibition Hall has again been reserved for manufacturers' and dealers' exhibits. All reservations should be directed to Dr. C. Davidson, Chairman Exhibit Committee, 185 N. Wabash Ave., Chicago, Ill.

HARRIS W. MCCLAIN, President,
HOWARD C. MILLER, Secretary,
55 East Washington Street.

---

**Eighth International Dental Congress**

The Eighth International Dental Congress is to be held in Paris, August 3-8, 1931.

An important exhibition of dental equipment and supplies will be connected with this Congress and will unite exhibitors from all the countries in the world.

The French Government has placed at our disposal the premises of the Grand Palais des Champs Elysées. In order to be able, already now, to proceed with the repartition of the rooms, we desire to collect as quickly as possible the names of suppliers susceptible of taking part in this exhibition. Consequently, we should be glad if you would inform us whether you intend to participate in this exhibition of the Eighth International Dental Congress and, eventually to indicate what space you would require. Your reply will not constitute an engagement on your part, nor on ours. We request same by way of information, to enable our establishing already now, the spaces which will be required.

The terms will be fixed shortly; we think that the rent, for the duration of the Congress will come to about 500 frs. per square metre.

HENRI VILLAIN,
Commissaire Général des Expositions.

### Harvard Society of Orthodontists

The alumni of the Graduate Course in Orthodontia at the Harvard University Dental School have organized the Harvard Society of Orthodontists.

The constitution embodies the principles as set forth by the American Society of Orthodontists.

The officers of the society are: Fred R. Blumenthal, honorary president; Chester L. Sandiford, president; Patrick L. Fox, vice president; Philip A. Enholm, treasurer; A. Lincoln Adelman, secretary; Ralph W. Short, educational chairman.

---

### Notes of Interest

Dr. Clinton C. Howard announces change of offices to the Atlanta National Bank Bldg., Atlanta, Ga.